ANNOTATED BIBLIOGRAPHY OF NEMATODES OF SOYBEANS

1882-1968

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This bibliography was initiated to bring together in one publication a list of references on nematodes of soybeans. Soybean ranks among the leading money crops in the United States. In the future, research on nematodes must be expanded to study the many kinds that are associated with this crop. In its present form this bibliography covers 380 titles published from 1882 through 1968. Many papers from Asia, South America, and Africa are listed; these are not readily accessible to western readers. Also, a publication of this nature cannot possibly be complete and a number of titles related to this subject, especially those of short publications, may have been overlooked. We shall greatly appreciate the reader's bringing such omissions to our attention.

The titles are listed numerically in alphabetical order according to the author's name. The appendix lists the scientific names of the genera and some species and the numerical reference to literature contained in the bibliography. Many kinds of nematodes of soybeans have been studied, but most of the work to date has been on a few that have caused losses to the crop. A miscellaneous list is included for the kinds that are referred to just a few times in the literature.

1. ANONYMOUS. 1922. Investigations on chlorosis of soybeans. J. Plant Protect. (Tokyo) 9:101-105. Hokkaido Natl. Agr. Expt. Sta. [In Japanese.]

1/ J. M. Epps, now with Southern Region, West Tennessee Experiment Station, Jackson, Tenn. 38301; D. I. Edwards, now with North Central Region, Department of Plant Pathology, University of Illinois, Urbana 61803; J. M. Good and R. V. Rebois, now with Northeastern Region, Plant Nematology Laboratory, Agricultural Research Center West, Beltsville, Md. 20705

The history of the disease was traced to Frank in 1881. The casual organism was identified as Heterodera schachtii. The susceptibility of Japanese varieties of soybean to disease was recorded. The disease was especially prevalent under the following conditions: (1) When soybeans were rotated with other susceptible crops; (2) on soils with inadequate fertilizers; and (3) on dry, sandy soils with poor water-holding capacity.

2. ANONYMOUS. 1937. Experiments on the prevention of soybean chlorosis. J. Plant Protect. (Tokyo) 24:624-625. [In Japanese.]

Treating soil with formalin and chloropicrin reduced soybean chlorosis but also decreased the yield of soybeans.

3. ______ 1938. Root-knot nematode control by cultural practices. Ga. Coastal Plains Expt. Sta. Ann. Rpt. 1937-38, Bul. 29, 130 pp.

Rotations with cotton, corn, root-knot resistant soybeans (Laredo and Biloxi), and root-knot resistant cowpeas (Brabham and Iron) are of only slight value in decreasing root knot in heavily infested fields.

4. ______ 1960. Distribution of plant-parasitic nematodes in the South. South. Coop. Bul. 74, 72 pp.

A report is given by the cooperators in the Southern States (S-19 Committee) on the known distribution of the plant-parasitic nematodes. Many nematodes attack soybeans. Sixty-eight species and genera are listed.

5. AIST, SHEILA, and R. D. RIGGS. 1967. Amino acids from Heterodera glycines larvae. (Abs.) Phytopathology 57(8): 801.

As part of a study on the chemistry of resistance in soybean to the soybean-cyst nematode, amino acids discharged by the second-stage larvae during incubation in deionized water were compared with those extracted from homogenized nematodes. Aspartic acid, glutamic acid, serine, glycine, and alanine, plus two unidentified ninhydrin positive spots, were extracted from the incubation solution. Aspartic acid, glutamic acid, serine, glycine, alanine, threonine, and glutamine, plus seven other spots tentatively identified as lysine or ornithine, and isoleucine were found in the hemogenate.

6. ASAI, K., and Y. NISHIO. 1965. Seasonal prevalence of soybean-cyst nematode: The influence of D-D treatment of soil. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 86:40-43.

The effect of soil fumigation with D-D on the seasonal prevalence of soybean-cyst nematode (Heterodera glycines) was studied. The number of larvae in soil and in root tissue was reduced to a markedly low level by soil fumigation during almost the entire soybean-growing season. The growth of soybean was excellent in the fumigated soil. However, at harvesttime there was no difference in the number of cysts on plants in the fumigated and nonfumigated soil.

7. ______ M. NISHIO, and T. OKADA. 1964. [Outbreaks of Heterodera glycines.] Soc. Plant Protect. No. Japan, Ann. Rpt. 15:138-139.

Distribution of Heterodera glycines in Japan is reported.

8. ATKINSON, R. E. 1944. Diseases of soybeans and peanuts in the Carolinas in 1943. U.S. Dept. Agr., Plant Dis. Rptr. Sup. 148:254-259.

State records on the occurrence and prevalence of root-knot nematodes are included.

9. AYCOCK, R. 1959. Relation of fungicidal and nematocidal bulb treatments to phytotoxicity and control of basal rot in narcissus. Phytopathology 49(1):12-16.

10. BARKER, K. R., AND J. N. SASSER. 1959. Biology and control of the stem nematode. Ditylenchus dipsaci. Phytopathology 49(10): 664-670.

Lee variety of soybean was susceptible to Ditylenchus dipsaci.

11. BARRONS, K. C. 1938. Varietal differences in resistance to root-knot in economic plants. U.S. Dept. Agr., Plant Dis. Rptr. Sup. 109:143-151.

The soybean variety Biloxi was almost free of galls in soil artifically inoculated with Heterodera marioni.

12. BERGESON, G. B., and K. L. ATHOW. 1963. Vector relationship to tobacco ringspot virus (TRSV) and Xiphinema americanum and the importance of this vector in TRSV infection of soybean. (Abs.) Phytopathology 53(8):871.

Control of Xiphinema americanum in field trials significantly reduced the number of soybean plants with TRSV-infected roots but had no effect on the amount of foliage infection.

13. BERGESON, G. B., F. A. LAVIOLETTE, and SISTER MARY THOMASINE. 1964. Transmission, movement, and vector relationships of tobacco ringspot virus in soybean. Phytopathology 54(6): 723-728.

Tobacco ringspot virus (TRSV) was transmitted by Xiphinema americanum from infected cucumber or soybean to cucumber but only rarely to soybean. Some transmission to soybean by thrips was demonstrated.

14. BIRCHFIELD, WRAY. 1954. The reproduction of Tylenchorhynchus sp. from sugarcane soils on different plants. (Abs.) Proc. Assoc. So. Agr. Workers 51:152-153.

Pelican and Acadian soybeans proved to be fairly good hosts for an unnamed species of Tylenchorhynchus.

15. ______ and W. J. MARTIN. 1956. Pathogencity on sugarcane and host plant studies of a species of Tylenchorhynchus. Phytopathology 46(5):277-280.

The nematode was found to reproduce on Pelican and Acadian soybeans, which are used in sugarcane crop-rotation programs.

16. ______ and R. MOTSINGER. 1967. Soybean-cyst nematode found in Louisiana. U.S. Dept. Agr., Plant Dis. Rptr. 51(10):823.

Chlorotic foliage, dwarfing, and cysts were found on soybeans in Richland Parish, 2 miles east of Start, La. This is the first reported occurrence of the soybean-cyst nematode in Louisiana.

17. BOOCK, O. J. 1950. Dowfume W-10 no combate aos nematoides que parasitam as plantas de soja. Rev. de Agr. (Brazil) 25(9/10): 297-304.

EDB at 30 gallons per acre gave excellent control of Heterodera marioni on the soybean variety Max Pyser. No effect on root nodulation was noted.

18. BRIM, C. A., and J. P. ROSS. 1963. Soybean cyst nematode resistant strain developed. Res. and Farming. pp. 12-13. Autumn 1963.

The first adapted strain of soybean with high resistance to the soybean-cyst nematode is reported. The strain has been designated NC 55 and made available to research workers.

19. ______ and J. P. ROSS. 1964. A cyst nematode resistant soybean strain. Soybean Digest 24(1):17.

NC 55, a black-seeded soybean line developed at the North Carolina Agricultural Experiment Station, is resistant to Heterodera glycines. NC 55 resulted from the third backcross of Lee to the original cross of Lee x Peking. Seed was increased in the winter of 1962 in Puerto Rico for 1963 field trials.

20. ______ and J. ROSS. 1966. Relative resistance of Pickett soybean to various strains of Heterodera glycines. Phytopathology 56(4): 451-454.

The new soybean variety, Pickett, is resistant to strains of the soybean-cyst nematode in Missouri, North Carolina, and Tennessee, but not to the strain in Virginia. Yield advantage of resistant lines such as Pickett compared with yield of Lee on infested soil depends on the nematode population density.

21. BROWN, J. G. 1948. Root-knot in Arizona. Univ. Ariz. Agr. Expt. Sta. Bul. 212, 40 pp.

This paper lists some varieties as susceptible to the root-knot nematode.

22. BRYANT, W. E., and T. D. WYLLIE. 1968. Effect of temperature and variety on nematode development and gall production on soybeans infected with Meloidogyne incognita acrita. (Abs.) Phytopathology 58:1045.

The responses of four soybean varieties, Scott, Clark, Hill, and Anderson, to infection by Meloidogyne incognita acrita were compared in growth chambers.

23. CALDWELL, B. E., C. A. BRIM, and J. P. ROSS. 1960. Inheritance of resistance to the soybean-cyst nematode. The results indicate that resistance is due to three independent recessive genes.

This is a report of the studies to determine the inheritance of resistance to the soybean-cyst nematode. The results indicate that resistance is due to three independent recessive genes.

resistance to the soybean-cyst nematode. The results indicate that resistance is due to three independent recessive genes.

24. CARVALHO, J. C. 1954. A soja e seus inimogos do solo. [Soybean and its soil enemies.] Rev. Inst. Adolfo Lutz 14(1):45-52. [In Portuguese, with English summary.]

Following from Biol. Abs.: "Soybean var. cultivated in the state of Sao Paulo have been severely attacked by root-knot nematodes, including at least 4 species: Meloidogyne javanica, M. arenaria, M. incognita, and M. hapla were present in roots of an unknown soybean var. cultivated in Terra. Roxa." (Author abs.).

25. ______ 1958. Rotylenchus elisensis nova especie associada com raizes de soja. Rev. Inst. Adolfo Lutz 17:43-46.

A new nematode species found in a soil sample from a soybean field was described as Rotylenchus elisensis. R. elisensis is different from other described species in that male and female tails are arcuate ventrally and the terminus resembles that of Paratylenchus macrophallus.

26. ______ 1959. Helicotylenchus elisensis no. comb. (Nematoda: Tylenchidae). Arch. Inst. Biol. Sao Paulo 26:45-48. [In Portuguese, with English summary.]

Rotylenchus elisensis is synonomized with Helicotylenchus elisensis.

27. CHAMBERS, A. Y., and J. M. EPPS. 1965. Comparative suitability of hosts for reproduction of Heterodera glycines. (Abs.) Phytopathology 55(5):497.

Reproduction was compared on 11 cultivated and weed hosts in greenhouse experiments. Some of the hosts allowed greater reproduction of the nematodes than others. Some were better hosts than Lee variety of soybean.

28. ______ and J. M. EPPS. 1966. Nature of resistance in soybean varieties and breeding lines resistant to Heterodera glycines. (Abs.) Phytopathology 56(8):873.

Results indicate that the factor, or factors, for resistance or susceptibility to Heterodera glycines is contained in all tissues of the soybean plant and is not synthesized in one part and translocated to the other parts.

29. CHAMBERS, A. Y., and J. M. EPPS. 1967. Nature of soybean resistance to Heterodera glycines. U.S. Dept. Agr., Plant Dis. Rptr. 51(9):771-774.

The factor(s) for resistance to the soybean-cyst nematode is not synthesized in the aboveground parts of the plant and translocated to the roots. The authors conclude that resistance is genetically inherent in the entire plant, but it expresses itself as localized tissue reaction at sites of root infection.

30. CHITWOOD, B. G. and WRAY BIRCHFIELD. 1956. Nematodes, their kinds and characteristics. State Plant Bd. Fla. 2:9.

Reference is made to the control of the soybean-cyst nematode by crop rotation. Several hosts of the cyst nematode are mentioned.

31. CHRISTIE, J. R. 1952. Some new nematode species of critical importance to Florida growers. Soil and Crop Sci. Soc. Fla. Proc. 12:30-39.

This paper reports and gives good information on the sting, stubby-root, dagger, and root-knot species of nematodes and lists some of their host crops. Soybeans are mentioned as being severely injured by the sting nematode, Belonolaimus gracilis.

32. ______ 1959. Plant nematodes - their bionomics and control. 256. pp. Agr. Expt. Sta., Univ. Fla., Gainesville, H. and W. B. Drew Co.

A number of references are about nematodes of soybeans. Suggestions for control as well as use of resistant varieties are discussed.

33. CHU, H. T. and C. CHUANG-YANG. 1961. [Investigation on soybean diseases.] Taiwan Sugar Expt. Sta. Rpt. 25:11-25. [In Chinese with English summary.]

Effects of Meloidogyne javanica on yields of soybean varieties Acadian, Shih-shih, Sankuo, Palmetto, Peal bean, Autum Yellow, Wakashima, Kae-hsium 207, Agr. College I, and Dortchsoy strain 2.

34. COBB, G. S., G. STEINER, and F. S. BLANTON, 1934. Observations on the significance of weeds as carriers of the bulb or stem nematodes in narcissus plantings. U.S. Dept. Agr., Plant Dis. Rptr. 18(10):127-129.

Soybean is listed as one of the plants infected by Anguillulina dipsaci.

35. COLBRAN, R. E. 1958. Studies of plant and soil nematodes. 2. Queenland host records or root-knot nematodes (Meloidogyne species). Queensland J. Agr. Sci. 15(3):101-136.

Meloidogyne species found in Queensland are M. javanica (Treub) Chitwood, M. hapla Chitwood, and M. incognita (Kofoid and White) Chitwood. Within these species there are distinct physiological races. The records are presented in two sections. In the first, the hosts are arranged in alphabetical order with data on nematode parasites, maximum severity of infestation observed, locality, and susceptibility of test plants; in the second, the relevant hosts are listed under each of the Meloidogyne species. The host list includes 269 species in 62 botanical families. Many of these are new records.

36. COURSEN, B. W., R. A. ROHDE, and W. R. JENKINS. 1958. Additions to the host lists of the nematodes Paratylenchus projectus and Trichodorus christiei. U.S. Dept. Agr., Plant Dis. Rptr. 42(4):456-460.

Soybean varieties, Dorman, John Kolk Clark, Lee and Ogden, are listed as host of the pin nematode, Paratylenchus projectus. The same varieties, with the exception of Ogden, are listed as host of root nematode, Trichodorus christiei.

37. COX, C. E., and W. F. JEFFERS. 1946. Root-knot Univ. of Md. Ext. Serv. Bul. 113.

Soybean is listed as susceptible to Heterodera marioni.

38. CRITTENDEN, H. W. 1952. Progress in the search for a root-knot nematode resistant crop. Trans. Peninsula Hort. Soc. Bul., Del. State Bd. Agr. 42:28-31.

In a root-knot control program, there is a need for a resistant crop that can be rotated with vegetables and is profitable to grow. Three commercial varieties of soybeans (Anderson, Monroe, and Blackhawk), acceptable for seed production in Delaware, appear to have a high degree of resistance to the root-knot nematode, Meloidogyne incognita acrita. The variety Laredo was the most resistant variety tested, but it is suitable only for hay or a green mature crop in Delaware.

39. ______ 1953. Effect of clean fallow in root-knot development on soybeans. (Abs.) Phytopathology 43(7):405.

These experiments using soybean indicate that the root-knot nematode in the top 6 inches of the soil was greatly reduced as a result of clean fallow and cultivation of a loamy sand during June.

40. CRITTENDEN, H. W. 1953. Progress in control of the root-knot nematodes by the use of clean fallow. Trans. Peninsula Hort. Soc. Bul., Del. State Bd. Agr. 43:15-18.

In two experiments, root-knot infection of soybean varieties caused by Meloidogyne incognita var. acrita became progressively lower as the period of clean fallow increased. Soybeans were planted at intervals, beginning May 15 and ending August 15; fallowed soil was maintained free of vegetation by tilling once every 2 weeks.

41. ______ 1954. Factors associated with root-knot nematode resistance in soybeans. (Abs.) Phytopathology 44(7):388.

A study of the factors that may be associated with root-knot nematode resistance in soybean indicate that resistant varieties should possess certain characteristics in order to have greatest resistance to root-knot nematode.

42. ______ 1955. Root-knot nematode resistance of soybeans. (Abs.) Phytopathology 45(6):347.

Fifty varieties of soybeans were evaluated for resistance to Meloidogyne incognita var. acrita. Laredo, Mukden, Anderson, Monroe, and Blackhawk were resistant to M. hapla.

43. ______ 1956. Control of Meloidogyne incognita by crop rotation. U.S. Dept. Agr., Plant Dis. Rptr. 40(11):977-980.

One year of a resistant crop results in some control on a susceptible crop the next year. The degree of control obtained may be satisfactory under some conditions.

44. ______ 1958. Histology and cytology of susceptible and resistant soybeans infected with Meloidogyne incognita acrita. (Abs.) Phytopathology 48(8):461.

Three varieties of root-knot nematode-susceptible soybeans (Virginia, Adams, and Hakote) and five resistant varieties (Blackhawk, Mukden, Anderson, Laredo, and Jackson) were exposed to M. incognita acrita. Each of the three susceptible varieties exhibited the following characteristics, (1) Giant cells surrounding the head of the nematode; (2) large number of giant cells; (3) large size of giant cell area; (4) very dense cytoplasm (5) great number of enlarged nuclei in each giant cell; and (6) great enlargement of pericycle, with giant cells occuring frequently in this region. The five resistant varieties exhibited a gradation of abnormal tissues and cells that corresponded to their degree of resistance based on field and greenhouse tests.

45. CRITTENDEN, H. W. 1959. Pathogen-suscept relationship of _Meloidogyne incognita acrita_ and _Glycine max_. Diss. Abs. 19(9):2219.

46. ______ 1959. Production of lateral roots in soybean varieties resistant and susceptible to _Meloidogyne incognita acrita_. (Abs.) Phytopathology 49(8):523.

Two susceptible and two resistant varieties of soybeans were exposed to M. incognita acrita for periods of 8, 16, and 32 days to study root development. When the secondary roots were invaded by the nematode, each of the two susceptible varieties, at 8 and 16 days of age, exhibited a reduction in number of tertiary roots produced (significant at 0.01 level) as compared with number of tertiary roots produced on the same varieties in uninfested soil. Each of the resistant varieties exhibited no change in tertiary root production when grown in infested soil compared with roots produced in uninfested soil.

47. ______ 1961. Studies of the host range of _Meloidogyne incognita acrita_. U.S. Dept. Agr., Plant Dis. Rptr. 45(3):190-191.

This report covers field and greenhouse studied in Delaware of the host range of _Meloidogyne incognita acrita_ Chitwood, 1949. Resistance to _M. incognita acrita_ exists in soybean varieties. The use of resistant soybean varieties in the summer and a resistant oat variety as a winter cover crop is suggested as a nematode control program.

48. ______ 1962. Effect of _Meloidogyne incognita acrita_ in nodulating and non-nodulating strains of soybean. (Abs.) Phytopathology 52(2):163.

A study was made of nodulating and nonnodulating lines of soybeans and the relationship to _M. incognita acrita_.

49. DADE, H. A. 1940. A revised list of Gold Coast fungi and plant diseases. Kew Roy. Gard. Bul. Misc. Inform. 1940:205-247.

Unidentified nematodes were found at Abusi and Kiki causing root knot and stunting on soybeans.

50. DAO, F. 1962. Plantas lasperderas del nematodo causante de los nodulos en las raices _Meloidogyne arenari thamesi_ Chitwood, 1952. Agron. Trop. Maracay 12:13-33.

M. arenaria thamesi from carnation, grape, and lettuce differed in galling on soybean. M.S. Thesis, Univ. Calif. Berkeley. 1960.

51. DE ARRUDA, H. VAZ. 1952. Analise de uma experiencia sobre varie-dades de soja. Bragantia 12(1/3):65-73.

Soybeans in Brazil are parasitized by two forms of root-knot nematodes closely related to Meloidogyne incognita. Twenty-one soybean varieties were tested for resistance to these forms. N 46-2652, a variety considered resistant in the Southern United States, was susceptible. Varieties Palmetto, La. 41-1219, N 45-3799, and Otootan were resistant in field or pot tests.

52. DE GUERPEL, H. 1942. Les ennemis et les maladies du soja, Rev. de Bot. Appl. et d' Agr. Trop. 17:195-201.

Heterodera schachtii was not found in France.

53. DROPKIN, V. H. 1959. Varietal response of soybeans to Meloidogyne - a bioassay system for separating races of root-knot nematodes. Phytopathology 49(1):18-23.

The host-parasite interactions between soybeans and four species of Meloidogyne are presented as a basis for bioassay procedures to distinguish races of root-knot nematodes.

54. ______ 1963. Effects of temperature on growth of root-knot nematodes in soybeans and tobacco. Phytopathology 53(6):663-666.

Temperature is one of several environmental components that can influence the success of a nematode parasite in a host.

55. ______ and P. E. NELSON. 1960. The histopathology of root-knot nematode infection in soybeans. Phytopathology 50(6):442-447.

Histological response to infection was studied in 19 soybean varieties infected with populations of root-knot nematodes, Meloidogyne incognita incognita and M. incognita acrita, and with M. arenaria arenaria.

56. DUNLEAVY, J. M., D. W. CHAMBERLAIN, and J. P. ROSS. 1966. Soybean diseases. U.S. Dept. Agr., Agr. Handb. 302, 38 pp.

Nematode diseases of soybeans and their suggested control measures are presented.

57. EDWARDS, D. I. 1962. Biology and host-parasite relations of the stem nematode of onions, Ditylenchus dipsaci (Kuhn, 1857) Filipjev. 1936. 72 --. Ph D. Thesis, Univ. Ill.

Soybean variety Harosoy proved to be an excellent host of the stem nematode of onion, Ditylenchus dipsaci. Symptomatology on stems, cotyledons, and leaves of soybean were described for the first time. Puckering and wrinkling on the primary leaves, stem browning, and general stunting of the entire plant were characteristic symptoms.

58. EDWARDS, D. I. 1963. Biology and host-parasite relations of the stem nematode of onion, Ditylenchus dipsaci (Kuhn, 1857) Filipjev, 1936. Diss. Abs. 23(11):4058-4059.

Soybean was rated as an excellent host of the onion race of the stem nematode, Ditylenchus dipsaci. Symptomatology on primary and trifoliate leaves, cotyledons, and stems of soybean are described for the first time.

59. ______ and D. P. TAYLOR. 1963. Host range of an Illinois population of the stem nematode (Ditylenchus dipsaci) isolated from onion. Nematologica 9(3):305-312.

Soybean variety Harosoy proved to be an excellent host of the Illinois population of the stem nematode (Ditylenchus dipsaci) isolated from onion. Before this host determination, the survival of D. dipsaci in a commercial onion set field probably occurred when soybean was used as a rotation crop in the second growing season of a 3-year rotation.

60. ______ and D. P. TAYLOR. 1963. Soybean as a host of the stem nematode isolated from onion. Ill. Res. 5(4):16.

The symptomatology of Ditylenchus dipsaci on soybean (variety Chippewa) is described. Typical symptoms include: Thickened cotyledons with chlorotic areas; wrinkled and puckered leaflets on an occasional trifoliate leaf; brown streaks on the stem area below the leaves; and general retardation of plant growth. A high inoculum level of 5,000 preadult nematodes per 6-inch pot killed all soybean plants after 6 weeks.

61. ENDO, B. Y. 1959. Response of root-lesion nematodes, Praylenchus brachyurus and P. zeae to various plants and soil types. Phytopathology 49(7):417-421.

Soybean, variety Lee, supported high populations of Pratylenchus brachyurus. Lee was also a suitable host for P. zeae; certain soil favored infection and reproduction.

62. ______ 1961. Desiccation studies on the soybean cyst nematode, Heterodera glycines, under controlled humidity conditions. (Abs.) Phytopathology 51(9):643.

The results indicate that desiccation under normal storage conditions greatly reduces nematode populations on infested plant parts and equipment. However, eradication appears very difficult under normal fluctuating atmospheric conditions.

63. ENDO, B. Y. 1962. Anatomical studies of soybean roots artifically inoculated with Heterodera glycines. (Abs.) Phytopathology 52(8):731.

Roots of Lee soybeans were stained with safranin and fast green to study changes in the nematode at the feeding sites.

64. ______ 1962. Lethal time-temperature relations for Heterodera glycines. Phytopathology 52(10):992-997.

Research to establish the lethal time-temperature combinations of larvae in cysts, larvae in eggs, and free larvae of the soybean-cyst nematode is discussed.

65. ______ 1962. Responses of Heterodera glycines to lethal temperatures. (Abs.) Phytopathology 52(1):9.

Hot water treatments were used to determine the lethal time-temperature relationships of the soybean-cyst nematode.

66. ______ 1962. Studies on the desiccation of the soybean-cyst nematode under controlled relative humidity conditions. Tenn. Farm and Home Sci. Prog. Rpt. 42:12-13.

Survival of cysts in soil, free cysts, free eggs, and free larvae at different humidity levels and time intervals was studied.

67. ______ 1962. Survival of Heterodera glycines at controlled relative humidities. Phytopathology 52(1):80-88.

Survival of cysts in soil, free cysts, free larvae, and free eggs at different humidity levels and time intervals is included.

68. ______ 1963. Penetration, infection, and development of Heterodera glycines in soybean roots and relative anatomical change. (Abs.) Proc. Assoc. So. Agri. Workers, Inc. 60th Ann. Conv., Memphis, Tenn., 1963. p. 284.

An investigation was made on penetration and infection by larvae of the soybean-cyst nematode and the ensuing anatomical changes. Phytopathology 54(1):79-88.

69. ENDO, B. Y. 1964. Penetration and development of Heterodera glycines in soybean roots and related anatomical changes. Phytopathology 54(1):79-88.

An investigation was made on penetration and infection by larvae of the soybean-cyst nematode and the ensuing anatomical changes occurring in roots of Lee soybeans.

70. ______ 1965. Entry and development of Heterodera glycines Ichinohe in susceptible and resistant soybeans. (Abs.) Nematologica 11(1):36.

Comparative observations were made on Heterodera glycines entry and development in resistant Peking and susceptible Lee. In the resistant variety, development of male and female nematodes was associated with syncytial development and host tissue changes. At the termination of nematode feeding and syncytial collapse, parenchymatous cells invaded regions around the syncytia. In Peking syncytia developed in 2-3 days and degenerated in 5 days after inoculation. With 8-10 days after inoculation, rejuvenative parenchyma cells had invaded the root tissues vacated by degenerate syncytia. Lee x Peking BC_2F_4 soybean roots were less resistant to nematode development than the parent, Peking.

71. ______ 1965. Histological responses of resistant and susceptible varieties and backcross progeny to entry and development of Heterodera glycines. Phytopathology 55(4):375-381.

Comparative observations were made on soybean-cyst nematode entry and development in soybean (Glycine max 'Lee' and 'Peking') and in the resistant backcross progeny. In Lee soybean, progressive development of male and female syncytial development was studied.

72. ______ 1967. Comparative population increase of Pratylenchus brachyurus and P. zeae and in soybean varieties Lee and Peking. Phytopathology 57(2):118-120.

A comparison was made between Golden Bamtam corn and the soybean varieties for population increase.

73. ______ 1967. Comparative reproduction of Pratylenchus brachyurus and P. zeae in corn and soybean varieties, 'Lee' and 'Peking'. (Abs.) Nematologica 13(1):140-141.

See (72).

74. ENDO, B. Y. and J. N. SASSER. 1957. The effectiveness of various soil fumigants for control of the soybean-cyst nematode. (Abs.) Phytopathology 47(1):9.

There was an inverse correlation between high cyst counts and nitrogen nodule formation. No fumigation treatment completely eradicated the nematodes from the soil.

75. ______ and J. N. SASSER. 1958. Fumigation controls soybean-cyst nematode. N.C. Agr. Expt. Sta. Res. and Farming 15(4):7.

Treating soil infested with Heterodera glycines Inchinohe with D-D at 40 and 60 gal./A., Telone at 40 gal./A., Nemagon at 5 gal./A., and methyl bromide at 1, 2, and 3 lbs./100 sq. ft. increased growth and yield of soybeans. Nodulation in infested soil was increased by nematicide treatment. At harvesttime, nematode populations had built up again. A brief literature review and history are included.

76. ______ and J. N. SASSER. 1958. Soil fumigation experiments for the control of the soybean-cyst nematode, Heterodera glycines. Phytopathology 48_10):571-574.

This is a report of investigations on the effectiveness of several soil fumigants on control of the nematode in field experiments. Effective control was obtained, but in no case was the nematode eradicated in the plots. MBR, DD, and DBCP were more effective than EDB.

77. EPPS, J. M. 1957. Soybean-cyst nematode found in Tennessee. U.S. Dept. Agr. Plant Dis. Rptr. 41(1):33.

The soybean-cyst nematode was found in a soybean field near Ridgely, Tenn. This is the second time the nematode has been reported in the United States.

78. ______ 1958. Viability of air-dried Heterodera glycines cysts. U.S. Dept. Agr. Plant Dis. Rptr. 42(5):594-595.

Live larvae were found in 3 cysts after storage for 1 month; none were found after storage.

79. ______ 1960. Evaluation of crop rotations and soil fumigation for controlling the soybean-cyst nematode. (Abs.) Phytopathology 50(9):635.

Yields of soybeans were increased with applications of nematicides in plots planted after a crop of cotton. Populations of soybean-cyst nematodes increased more rapidly on soybeans growth after fumigation or rotation than on soybeans grown after soybeans.

80. EPPS, J. M. 1963. Effects of sugar treatments on the viability of eggs and larvae in Heterodera glycines cysts, and larvae and adults of other nematode species. U.S. Dept. Agr. Plant Dis. Rptr. 47(3):180-182.

Soybean seed planted in soil containing more than 2.5 percent sugar failed to emerge. The cyst nematodes were not all killed in sugar solutions and sugar-soil mixtures.

81. ______ 1965. Reaction of sugarbeet varieties to the soybean-cyst nematode. U.S. Dept. Agr. Plant Dis. Rptr. 49(9):747.

The soybean-cyst nematode did not reproduce on 15 sugarbeet varieties.

82. ______ 1968. Survival of soybean-cyst nematodes in seed bags. U.S. Dept. Agr. Plant Dis. Rptr. 52(1):45.

Survival of larvae in cysts stored for 17, 18, and 22 months, or longer, in seed bags indicate that cyst-infested seed stocks may serve as a source of dispersion for the soybean-cyst nematode.

83. ______ and A. Y. CHAMBERS. 1958. New host records for Heterodera glycines; including one host in the Labiatae. U.S. Dept. Agr. Plant Dis. Rptr. 42(2):194.

Hemp sesbania (Sesbania macrocarpa), white lupine (Lupinus albus), and henbit deadnettle (Lamium amplexicaule) were the new hosts for the soybean-cyst nematode.

84. ______ and A. Y. CHAMBERS. 1959. Mung bean (Phaseolus aureaus), a host of soybean-cyst nematode (Heterodera glycines). U.S. Dept. Agr. Plant Dis. Rptr. 43(9):981-982.

Mung bean was reported as a new host for the soybean-cyst nematode.

85. ______ and A. Y. CHAMBERS. 1962. Effect of seed inoculation, soil fumigation, cropping sequences on soybean nodulation, soybeans grown in soybean-cyst nematode infested soil. (Abs.) Phytopathology 52(1):9.

Inoculation was not an effective means of increasing nodulation. Increased nodulation occurred in rotations with cotton and with fumigation before plantings.

86. EPPS, J. M. and A. Y. CHAMBERS. 1962. Effects of seed inoculation, soil fumigation, cropping sequences on soybean nodulation of of soybeans grown in soybean-cyst-nematode infested soil. U.S. Dept. Agr. Plant Dis. Rptr. 46(1):48-51.

Inoculation did not increase nodulation in soil heavily infested with soybean-cyst nematodes. Soil fumigation resulted in increased nodulation. Nodulation was significantly increased in a soybean-soybean-cotton rotation when compared with nodulation in continuous soybeans.

87. ______ and A. Y. CHAMBERS. 1962. Nematode inhibits nodules on soybeans. Crops and Soils 15:18.

The effects of seed inoculation, fumigation, and rotation with nonhost crops are reviewed.

88. ______ and A. Y. CHAMBERS. 1962. Soybean-cyst nematode--symptoms, life cycle, spread, host range, research on control. Tenn. Farm and Home Sci. 41:13-15.

The soybean-cyst nematode, with special emphasis on the nematode and research and progress to develop control measures, is discussed. This is a paper desgiend for the extension agent and growers of soybeans.

89. ______ and A. Y. CHAMBERS. 1963. Influence of planting date on yield of soybeans in fumigated and untreated soil infested with Heterodera glycines. U.S. Dept. Agr. Plant Dis. Rptr. 47(7):589-593.

Yields were comparable in plantings made from May 1 to May 15 in both fumigated and untreated soil. Greatest increases in yields occurred following soil fumigation in plantings made June 1 to July 15.

90. ______ and A. Y. CHAMBERS. 1963. Which seeding dates for soybeans on cyst-nematode-infested soil? Tenn. Farm and Home Sci. Prog. Rpt. 48:6-8.

In soil heavily infested with soybean-cyst nematodes, the highest yields were obtained from plantings.

91. ______ and A. Y. CHAMBERS. 1964. Behavior of populations of Heterodera glycines under various cropping sequences in field bins. (Abs.) Phytopathology 54(6):622.

Populations were reduced with cotton planted in rotation with soybeans. Where soybeans were planted continuously, the populations were always high. After a crop of cotton the populations were low, but reached a high level after the next crop of soybeans.

92. ______ and A. Y. CHAMBERS. 1964. Nematocidal seed treatment for control of Heterodera glycines in soybeans. (Abs.) Phytopathology 54(6):622.

Treatment of soybean seed with DBCP at rates of 1/8, 1/4, 1/3, and 1/2 gal./A. in the drill row caused a significant reduction in stand. There were significant reductions in white female development with the treatments.

93. ______ and A. Y. CHAMBERS. 1965. Behavior of soybean-cyst-populations under different cropping systems. Tenn. Farm and Home Sci. Prog. Rpt. 53, Jan., Feb., March, 1965.

The results of using different cropping systems to reduce the cyst nematode population are discussed.

94. ______ and A. Y. CHAMBERS. 1965. Nature of resistance in soybea varieties resistant to Heterodera glycines. (Abs.) Phytopathology 55(5):498.

When scions of susceptible soybean variety (Lee) were grafted ont rootstocks of resistant varieties (NC-55 and Peking), the roots of the resistant plants remained free of white female development. Scions of resistant varieties (NC-55 and Peking) were grafted onto rootstocks of susceptible variety (Lee), and this did not alter susceptibility of the rootstock, indicating that the factor responsible for resistance is not translocated from the tops to the roots.

95. ______ and A. Y. CHAMBERS. 1965. Population dynamics of Heterod glycines under various cropping sequences in field bins. Phytopathology 55(1):100-103.

Buildup and decline of the soybean-cyst nematode under seven different 5-year cropping sequences were studied. Populations built u when susceptible soybeans were grown. There was a sharp reduction in population after one and two crops of cotton or Peking (resistant) soybeans. Populations returned to high levels when susceptible soybea were planted in the rotation.

96. ______ and A. Y. CHAMBERS. 1966. Comparative rates of reproduction of Heterodera glycines on 12 host plants. U.S. De Agr. Plant Dis. Rptr. 50(8):608-610.

Hemp sesbania allowed two to four times more reproduction per gra root than soybean, and Kobe lespedez allowed approximately seven times more reproduction. Korean lespedeza, henbit deadnettle, and wild soyb allowed reproduction about equal to that of soybean. Sericea lespedez and hairy vetch were poor hosts for the soybean-cyst nematode.

97. EPPS, J. M. and A. Y. CHAMBERS. 1967. Control of the soybean-cyst nematode. Soybean Digest 27(9):6-9.

Distribution, symptoms and signs, host range, spread, and control of the soybean-cyst nematode are discussed. The results of soil fumigation crop rotation, and time of planting experiments are discussed and resistant varieties are described.

98. ______ and L. A. FISTER. 1941. Root-knot nematode in parts of west Tennessee. U.S. Dept. Agr. Plant Dis. Rptr. 25(20):510-512.

Root-knot nematodes were found associated with several crops, including soybeans.

99. ______ and A. M. GOLDEN. 1966. Significance of males in reproduction of the soybean-cyst nematode (Heterodera glycines). Proc. Helminthol. Soc. Wash. 33(1):34.

Males were necessary for reproduction of the soybean-cyst nematode. No reproduction occurred on the roots of plants inoculated with a single larvae.

100. ______ and A. M. GOLDEN. 1967. Biological differences in populations of the soybean-cyst nematode, Heterodera glycines. (Abs). Nematologica 13(1):141.

Isolates of the soybean-cyst nematode from Holland, Va., and Elizabeth City, N.C., developed on soybean varieties that were highly resistant to isolates from Arkansas, Missouri, and Tennessee.

101. ______ and A. M. GOLDEN. 1967. Suitability of Kobe lespedeza for reproduction of isolates of the soybean-cyst nematode from nine locations. U.S. Dept. Agr. Plant Dis. Rptr. 51(9):775-776.

Isolates of the soybean-cyst nematode (Heterodera glycines) reproduced on Lespedeza striata, variety Kobe, in greenhouse experiments. Some variations occurred in the rates of reproduction, but all isolates were highly pathogenic and could not be differentiated on this host. Kobe lespedeza may be an important host under field conditions.

102. ______ and E. E. HARTWIG. 1967. Dyer, a new nematode-resistant soybean variety. Univ. of Tenn., Bul. 426.

A new soybean variety Dyer was released by the Tennessee and Missouri Experiment Stations and U.S. Department of Agriculture. The variety has excellent resistance to the soybean-cyst nematode and two species of root-knot nematodes.

103. EPPS, J. M., J. N. SASSER, and G. UZZELL, JR. 1964. Lethal dosage concentrations of nematicides for the soybean-cyst nematode and the effect of a nonhost crop in reducing the population. Phytopathology 54(10):1265-1268.

Nematicides performed similarly at Wilmington, N.C., and Ridgely, Tenn. Populations of nematodes were greatly reduced with nematicide treatments. Populations declined when nonhost crops were planted in rotation with soybeans. Eradication was not accomplished in the experiments.

104. ______ J. N. SASSER, and G. UZZELL, JR. 1965. Relative effectiveness of various nematicides in controlling the soybean-cyst nematode and the added effect of a non-host crop in reducing the population. (Abs.) Nematologica 11(1):36-37.

This reports on the use of some nematicides and nonhost crops.

105. FASSULIOTIS, G., and G. J. RAU. 1967. The reniform nematode in South Carolina. (Abs). U.S. Dept. Agr. Plant Dis. Rptr. 51(7):557.

A report of Rotylenchulus reniformis on soybean. This is the first report of this nematode in South Carolina, but the author suggests that it may be present in other areas of South Carolina.

106. ______ G. J. RAU, and F. H. SMITH. 1968. Hoplolaimus columbus, a nematode parasite associated with cotton and soybeans in South Carolina. U.S. Dept. Agr. Plant Dis. Rptr. 52(7):571-572.

The Columbia lance nematode was found associated with cotton and soybeans. Soybean plants were dwarfed and chlorotic and had few pods. As many as 4,220 nematodes were recovered per 100 cc. of soil from the rhizosphere of soybean plants.

107. FENNE, S. B. 1940. Some observations on the development of root-knot nematode diseases in Virginia. (Abs). Phytopathology 30(8):708.

Bacterial leaf and pod spot, fusarium wilt, stem rot, root-knot, mosaic, and a nutritional deficiency were seen every year.

108. ______ 1942. More about soybean diseases from Virginia. U.S. Dept. Agr. Plant Dis. Rptr. 26:382.

Root knot is listed as one of the soybean diseases seen every year in Virginia.

109. FERRIS, V. R. 1961. A new species of Pratylenchus (Nemata-Tylenchida) from roots of soybeans. Proc. Helminthol. Soc. Wash. 29(2):109-111.

The author describes a new species, Pratylenchus alleni, found in the roots of nine soybean varieties from Eldorado, Ill.

110. ______ and R. L. BERNARD. 1958. Plant-parasitic nematodes associated with soybeans in Illinois. U.S. Dept. Agr. Plant Dis. Rptr. 42(6):798-801.

Plant parasitic genera of nematodes found widely distributed in Illinois soybean fields included Pratylenchus, Paratylenchus, Helicotylenchus, and Tylenchorhynchus. Comparisons of rotations indicated that the higher counts of Pratylenchus and Helicotylenchus in the soil were often associated with corn, whereas the higher counts of Pratylenchus were associated with soybean culture.

111. ______ and R. L. BERNARD. 1961. Seasonal variations of nematode populations in soybean field soil. U.S. Dept. Agr. Plant Dis. Rptr. 45(10):789-793.

Data on the fluctutations in the numbers of plant-parasitic nematodes in soils of soybean fields were obtained over a 3-year period. Populations of nematodes of the genera Paratylenchus, Helicotylenchus, and Tylenchorhynchus built up during the growing season and reached a peak near the end of the period. Populations of nematodes of the genus Pratylenchus in the soil usually reached a peak early in the season and a decline followed. Population decline was greatest during very dry periods.

112. ______ and R. L. BERNARD. 1962. Injury to soybeans caused by Pratylenchus alleni. U.S. Dept. Agr. Plant Dis. Rptr. 46(3):181-184.

Soybean plants grown in the greenhouse in the presence of Pratylenchus alleni, a species originally discovered in soybean breeding plots, had a reduced root weight of 25 percent. In one experiment this reduction was obtained at a level of infection comparable with that of field-grown plants. Under certain environmental conditions, infection with this nematode probably causes reduced growth and yield of field-grown soybean plants.

113. FERRIS, V. R. and R. L. BERNARD. 1963. Effect of host crop on soil populations of several Pratylenchus species. (Abs.) Phytopathology 53(8):875.

The influence of crop species on the soil populations of several species of Pratylenchus was followed in 16 fields in two types of rotations for 5 years.

114. _____ and R. L. BERNARD. 1967. Population dynamics of nematodes in fields planted to soybeans and crops grown in rotation with soybeans. I. The genus Pratylenchus (Nemata:Tylenchida). J. Econ. Ent. 60(2):405-410.

Based on samples collected in 16 fields in Illinois during 1958-62, P. penetrans, P. scribneri, P. neglectus, and, to a lesser extent, P. hexincisus built up in soybean fields.

115. _____ J. M. FERRIS, and R. L. BERNARD. 1967. Relative competitiveness of two species of Pratylenchus in soybeans. (Abs.) Nematologica 13(1):143.

Pratylenchus penetrans produced more females than P. alleni. The ratio of females to males in P. penetrans was 3:1 to 5:1, respectively, while it was about equal in P. alleni.

116. FIELDING, M. J., and J. P. HOLLIS. 1956. Occurrence of plant-parasitic nematodes in Louisiana soils. U.S. Dept. Agr. Plant Dis. Rptr. 40(5):403-405.

Six genera of plant-parasitic nematodes were found associated with 12 samples from soybean fields.

117. FILIPJEV, I. N., and J. H. SCHUURMANS STEKHOVEN. 1941. A manual of agricultural helminthology. 878 pp. E. J. Brill, Leiden, Holland, The Netherlands.

Soybean was listed as a host of Heterodera marioni and H. goettingiana reproduced freely on soybean. Ditylenchus dipsaci attacked soybean.

118. FOX, J. A. 1967. Reproductive isolation in the genus Heterodera. (Abs.) Nematologica 13(1):143-144.

Attempts were made to effect interspecific crosses between representatives of the round-cyst group (Osborne's cyst nematode), a representatives of the lemon-shaped group (H. glycines and H. carotae). Matings occurred between Osborne's cyst and H. glycines only.

119. FRANK, A. B. 1882. Gallen der Anguillula radicicola Greff an Soja hispida, Medicago sativa, Lactuca sativa, und Pirus communnis. Verb. Bot Prov. Bradenburg 23(2):54-55.

A short description is given of the root gall on soybeans in the greenhouse in Berlin.

120. FRANKLIN, M. T. 1951. The cyst-forming species of Heterodera. 147 pp. Commonwealth Agr. Bur., Farnham Royal Bucks, England.

This is a book on species of cyst-forming nematodes, their occurrence, morphology, hosts, type of damage, and economic importance.

121. ______ and D. J. HOPPER. 1959. Plants recorded as resistant to root-knot nematodes (Meloidogyne spp.). 33 pp. Commonwealth Agr. Bur., Farnham Royal Bucks, England.

Plants are listed from the studies.

122. FUJITA, K., and O. MIURA. 1934. On the parasitism of Heterodera schachtii Schmidt, on beans. Trans. Sapporo Nat. Hist. Soc. 13(3):359-364.

A study of the host range of this nematode revealed that it infects the soybean, adzuki, kidney, and multiflora beans, but did not attack other legumes tested.

123. FUKAZAWA, NORIMITSU, YOSHIAKI KOBAYASHI, and MASAHIKO NAKATA. 1962. [On the parasitic nematodes and their distribution in Shizuoka Prefecture, Japan.] Shizuoka Pref. Agr. Expt. Sta. Bul. 7:89-105. [In Japanese, with English summary.]

Heterodera glycines were found in a few places.

124. ______ and H. YARIMIZU. 1953. Control of the nematode Heterodera marioni (Cornu) (Goodey) on soybean. II. Residual effectiveness of DD (dichloropropane-dichloropropyene) application. J. Kanto-Tosan Agr. Expt. Sta. 4:23-26.

The residual effectiveness of DD and chloropircrin for the control of nematodes on soybeans was tested during 1949-51. DD gave good residual effectiveness for 1 year, but was found only in the early stage of plant growth. The 2d year chloropicrin was not as effective as DD. DD is too expensive for extensive farm use in Japan.

125. FUKUI, J., H. YARIMIZU, K. IISIMA, T. TANAKA, and S. IZUMI. 1953. Control of the nematode Heterodera marioni (Cornu) (Goodey) on soybean. I. Effect of DD (dichloropropane-dichloropropene) as worm killer. J. Kanto-Tosan Agr. Expt. Sta. 4:19-22.

The effects of DD and chloropicrin application on soybean nematodes in a field of alluvial soil on the Korean Experimental Farm in 1949 are summarized as follows: DD by injection was very effective. Chloropicrin gave some control, but was inferior to DD.

126. GASKIN, T. A., and H. W. CRITTENDEN. 1956. Studies of the host range of Meloidogyne hapla. U.S. Dept. Agr. Plant Dis. Rptr. 40(4):265-270.

The report covers studies of the host range of M. hapla. Varieties of soybeans varied in susceptibility.

127. GERDEMANN, J. W., and M. B. LINDFORD. 1953. A cyst-forming nematode attacking clovers in Illinois. Phytopathology 43(11):603-608.

A cyst-forming nematode identified as Heterodera schachtii var. trifolii did not attack soybean and some other crops.

128. GODFREY, G. H. 1928. Legumes as rotation and trap crops for nematode control in pineapple fields. Assoc. Pineapple Canners, Univ. Hawaii Expt. Sta. Bul. 10, 211 pp.

In tests to determine suitable rotation crops to control the root-knot nematode, the soybean variety Laredo was resistant. In another test to determine suitable trap crops, the soybean varieties Otootan, Biloxi, and Tarheel were all susceptible to the root-knot. No soybean varieties tested were considered desirable as rotation trap crops because they did not grow vigorously and were severely affected by the Japanese beetle.

129. ______ 1929. A destructive root disease of pineapples and other plants due to Tylenchus brachyurus n. sp. Phytopathology 19(7):611-629.

Soybean was infected by the nematode.

130. GOLDEN, A., and J. M. EPPS. 1965. Morphological variations in the soybean-cyst nematode. (Abs.) Nematologica 11(1):38.

Data obtained in studies of the soybean-cyst nematode indicate that this species is not morphologically uniform in all areas of occurrence. Three different types were noted.

131. GOOD, J. M. 1956. Plant-parasitic nematodes of Georgia. Agr. Expt. Sta. Serv. (n.s.) 26:1-14 [Mimeo.]

Nematodes commonly found in Georgia are root-knot species, meadow, sting, stubby-root, stylet, spiral, ring, dagger, and lance. The author discusses control by rotations and soil fumigants.

132. ______ 1968. Assessment of crop losses caused by nematodes in the United States. FAO Plant Protect. Bul. 16(3):37-40.

The author presents a comprehensive review of the methods used to determine nematode losses to agricultural crops, including soybeans.

133. GOODEY, T. 1940. The nematode parasites of plants catalogued under their hosts. 80 pp. Imp. Bur. Agr. Parasitol., St. Allans, England.

The paper lists soybean as a host of Anguillulina dipsaci (leaf gall), Anguillulina pratensis, Heterodera schachtii, and H. marioni.

134. ______ 1956. The nematode parasites of plants catalogued under their hosts. 140 pp. Rev. ed. by J. B. Goodey and M. T. Franklin. 140 pp. Commonwealth Agr. Bur., Farnham Royal Bucks, England.

Several common species of nematodes are listed as parasites of soybeans.

135. ______ 1963. Soil and freshwater nematodes. (Rev. by J. B. Goodey) Ed. 2, 544 pp. Methuen, London, England.

A textbook on nematodes in general, including brief mention of nematodes of soybean.

136. ______ M. T. FRANKLIN, and D. J. HOOPER. 1959. Supplement to the nematode parasites of plants catalogued under their hosts, 1955-58. 66 pp. Commonwealth Agr. Bur. Farnham Royal, Bucks, England.

New records of nematode parasites of Glycine hispida and G. soja (soybean) from the literature include Helicotylenchus nannus, Helicotylenchus sp., Meloidogyne inornata, M. javanica v. bauruensis, Paratylenchus projectus, P. penetrans, Pratylenchus spp., Rotylenchulus reniformis, Trichodorus christiei, Trichodorus sp., and Tylenchorhynchus sp.; T. martini on Acadian and Pelican varieties of Glycine hispida; Heterodera trifolii on Deerfield, Perry, Comet, Blackhawk, Earlyana, Hawkeye, and Richland varieties; Meloidogyne hapla on Laredo, Mukden, Anderson, Monroe, and Blackhawk varieties. Glycine javanica is parasitized by Meloidotyne incognita v. acrita and M. javanica; and Glycine ussurensis by Heterodera glycines.

137. GOTOH, AKIRA, and YASUOMI OHSHIMA. 1963. Pratylenchus-Arten und ihre geographische Verbreitung in Japan (Nematoda:Tylenchida). Jap. J. Appl. Ent. and Zool. 7:187-199.

Reports Pratylenchus penetrans, P. neglectus, and P. coffeae in soil around soybean roots. Gives comparative illustrations showing taxonomic differences in species.

138. GRAHAM, T. W., and O. L. HOLDEMAN. 1953. The sting nematode Belonolaimus gracilis Steiner: a parasite on cotton and other crops in South Carolina. Phytopathology 43(8):434-439.

Typical symptoms of sting-nematode damage occurred on soybeans in greenhouse tests.

139. HAMBLEN, M. L., and D. A. SLACK. 1959. Factors influencing the emergence of larvae from cysts of Heterodera glycines Ichinohe. Cyst development, condition, and variability. (Abs.) Phytopathology 49(5):317.

In laboratory studies, development of cysts and emergence of larvae from cysts were influenced by soil moisture before collection of cysts.

140. HARA, K. 1930. Pathologia agriculturalis plantarum. 950 pp. Tokyo. [In Japanese.]

Includes description accounts of soybean diseases and includes Heterodera schachtii.

141. HARLAN, D. P., and L. JENKINS. 1966. Elimination of soybean-cyst nematodes from the roots of plants by chemical dips. U.S. Dept. Agr. Plant Dis. Rptr. 50(8):548-549.

Cysts of Heterodera glycines, which had either been extracted from soil and mixed with sterile sand and sandy loam soil or were still attached to soybean roots, were dipped for 30 minutes in water solutions of nematicides. Checks for nematode survival were made by incorporating dipped material into pots planted with a susceptible soybean variety. O, O-diethyl O-2-pyrazinyl phosphorothioate at 2,530 p.p.m. (20 cc. per gallon) eliminated the soybean-cyst nematode in pot tests.

142. HART, W. H. 1959. Nematodes in plant quarantine. Calif. Agr. 13(9):4-5.

The soybean-cyst nematode, although it does not occur in California, is a serious pest of soybeans in the Mississippi Valley and in some Southeastern States.

143. HARTWIG, E. E. 1967. Soybean-cyst nematodes - A problem and a solution. Natl. Soybean Crop Improvement Council, Urbana, Ill, Soybean News 19(L):3-4, 6.

Background, symptoms, and early control measures are discussed for the soybean-cyst nematode. In Wilmington, N.C., a field planting with 3,500 soybean strains was made in infested soil. Strains appearing resistant were replanted in North Carolina and in greenhouse plots in Jackson, Tenn. to test them against the Tennessee isolate of the nematode. Peking and P.I. 90763 were highly resistant; Illsoy was moderately resistant. Breeding programs were set up in Mississippi, using these two strains. Coat color was found linked with one of the three recessive genes for resistance. Varieties Pickett, Custer, and Dyer were developed through State and Federal cooperative research. Custer and Dyer differ in their resistance to diseases and other nematodes, and in date of maturity. This pest is spreading despite quarantines.

144. HEGGE, A. H. 1957. Soybean-cyst nematode in Missouri. U.S. Dept. Agr. Plant Dis. Rptr. 41(3):201.

Examination of soil samples reveals the presence of the soybean-cyst nematode in eight fields in southeast Missouri.

145. HENDERSON, V. E., and H. KATZNELSON. 1961. The effect of plant roots on the nematode population of soil. Canad. J. Microbiol. 7:163-167.

Pratylenchus and Aphelenchus avenae were found in greatest numbers in the rhizosphere of soybean roots. Light intensity influenced numbers.

146. HIRSCHMANN, H. 1956. A morphological comparison of two cyst nematodes, Heterodera glycines and H. trifolii. (Abs.) Phytopathology 46(1):15.

Consistent differences in morphology were found that make a separation of the two species possible.

147. ______ 1956. Comparative morphological studies on the soybean-cyst nematode Heterodera glycines and the clover-cyst nematode H. trifolii (Nematoda:Heteroderidae). Proc. Helminthol. Soc. Wash. 23(2):140-151.

Morphological characters of the soybean-cyst nematode H. glycines and the clover-cyst nematode H. trifolii in North Carolina were studied.

148. ______ 1959. Histological studies on the anterior region of Heterodera glycines and Hoplolaimus tylenchiformis (Nematoda: Tylenchida). Proc. Helminthol. Soc. Wash. 26(2):73-90.

A detailed histological study is made of layering of the external cuticle, cephalic structures, body and stylet musculature, and hemizonid.

149. ______ 1960. External characters and body wall of nematodes. In Nematology, J. N. Sasser and W. R. Jenkins, editors. Chapter 10, pp. 130-135. Chapel Hill, N.C.

The external characters of many kinds of nematodes, including the soybean-cyst nematode, are given. Report also includes a study of the cuticle, hypodermis, and somatic musculature of nematodes.

150. ______ and A. C. TRIANTAPHYLLOU. 1962. Oogensis and reproduction in Heterodera glycines and H. trifolii. (Abs.) Phytopathology 52(1):13.

Oogonial divisions were observed in larvae of the fourth molt in two species of Heterodera. Reproduction in H. trifolii took place without males. In H. glycines reproduction was by cross fertilization.

151. HOLDEMAN, Q. O. 1955. The present known distribution of the sting nematodes, Belonolaimus gracilis, in the coastal plain of the Southeastern United States. U.S. Dept. Agr. Plant Dis. Rptr. 39(1):5-8.

The sting nematode was recovered from soybeans from North Carolina, South Carolina, and Virginia.

152. ______ and T. W. GRAHAM. 1953. The effect of different plant species on the population trends of the sting nematode. U.S. Dept. Agr. Plant Dis. Rptr. 37(10):497-500.

Soybean was a good host for the sting nematode, and high populations were recovered from this crop. Crops grown after soybeans were severely damaged by the nematode.

153. HOLSTON, E. M., and H. W. CRITTENDEN. 1951. Resistance of soybeans to root-knot nematodes. (Abs.) Phytopathology 41(6):562.

Eight soybean varieties were planted in a nematode-infested field to determine their resistance to Meloidogyne incognita var. acrita. Resistance was not found, but Illini was tolerant to root knot.

154. HORI, S. 1915. Phytopathological notes. 5. Sick soil of soybean caused by the nematodes. J. Plant Protect. (Tokyo) 2:927-930. [In Japanese.]

The first discovery of the soybean-cyst nematode is reported. Discovery was made on the roots of soybean plant sent from where the disease had been observed for many years. Calcium cyanimide soil treatment is recommended for control.

155. HU, C. H. 1963. A preliminary report of the effects of root-knot nematodes, Meloidogyne spp., on the growth of sugarcane and its interplanted crops. Taiwan Sugar Expt. Sta. Rpt. 31:121-136. [In Chinese with English summary.]

Soybeans grown in sterilized sea sand inoculated with root-knot nematodes showed severe galling and stunting of plants.

156. HUNG, Y. 1958. A preliminary report on the plant-parasitic nematodes of soybean crop of the Pingtung District, Taiwan, China. Agr. Pest News 5(4):1-5.

This paper reported finding the soybean-cyst nematode in Formosa (Taiwan).

157. ICHINOHE, MINORU. 1952. On the soybean nematode, Heterodera glycines no. sp., from Japan. Oyo-Dobutsugaka-Zasshi. [Soc. Appl. Zool., Tokyo.] 17(1/2:1-4.

He compared the soybean-cyst nematode with other species of Heterodera and described it under the name Heterodera glycines.

158. ______ 1953. On the parasitism of the soybean nematode, Heterodera glycines. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 64:113-124.

A report on the nematode infections indices of the soybean-cyst nematode on kidney bean, spanish runner bean, soybean, and adzuki bean is given. He based the indicates on the number of white females attacking the taproots of plants that were grown for 6 weeks in infested soil.

159. ______ 1955. [A study of the population of the soybean nematode, Heterodera glycines.] I. An observation on the relation between the crop damage and the female infestation. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 68:67-70. [In Japanese with English summary.]

This is an observation on the relation between crop damage and the female infestation; fewer females developed on roots of heavily infected plants than on those with low infection.

160. ______ 1955. Studies on the morphology and ecology of the soybean-cyst nematode, Heterodera glycines, in Japan. Hokkaido Natl. Agr. Expt. Sta. Rptr. 48:1-65.

Root leachates of several host and nonhost plants failed to stimulate emergence of larvae from cysts of H. glycines.

161. ______ 1955. Survey on the "yellow dwarf" disease of soybean plants caused by Heterodera glycines occurring in the peat soil in Hokkaido. Jap. J. Ecol. 5(1):23-26. [In Japanese with English summary.]

Glycine ussuriensis proved to be a host of the soybean-cyst nematode. This plant showed typical symptoms in the aboveground parts and seems similar to the soybean in susceptibility to this nematode. G. ussuriensis is a wild-type soybean and grows naturally in Honshu.

162. ICHINOHE, MINORU. 1959. Studies on the soybean-cyst nematode, Heterodera glycines and its injury to soybean plants in Japan. U.S. Dept. Agr. Plant Dis. Rptr. Sup. 260:239-248.

A general study is made of the soybean-cyst nematode, distribution morphology, symptoms, hosts, and control including use of resistant varieties.

163. ______ 1961. Studies on the sboyean-cyst nematode, Heterodera glycines. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 56:80 pp. [In Japanese with English summary.]

The paper describes the morphology, bionomics, and control of the soybean-cyst nematode. There is much information on this nematode, including sections on nature of parasitism, population dynamics, resistant varieties, and several methods of control.

164. ______ and KAZUO ASAI. 1956. Studies on the resistance of soybean plants to the nematode, Heterodera glycines to varieties Daiichi-Hicnuki and Nangun-Takedate. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 71:67-79. [In Japanese with English summary.]

They studied the resistance of the soybean varieties "Daiichi-hienuki" and "Nangun-takedate" to this nematode and found that certain features of these varieties were associated with resistance, for example, (1) failure of large numbers of the nematode larvae to survive after invasion, (2) increase in the activity of root-nodule bacteria, and (3) strong root growth and, in consequence, a good health of the entire plant.

165. ISHIKAWA, MASAZI, and TAKAYOSI MIYAHARA. 1958. Reaction of soybean varieties to the soybean nematode. (Heterodera glycines). Jap. J. Breeding. 8:111-118. [In Japanese with English summary.]

Some varieties showed resistance to the soybean-cyst nematode. Most varieties were susceptible and none were immune. Some showed effect of nematodes on flowering, maturity data, stem length, and bean size.

166. ISHIKAWA, T. 1916. Principal insect pests and diseases occurring during the fourth year of Taisho. II. Occurrence of "Moon Night" and wilt disease of soybean. J. Plant Protect. (Tokyo) 3:197.

A report of the occurence for many years of the soybean disease called "Moon Night Disease." Reported that the land became incapable of cropping soybean because of the disease.

167. ITO, S. 1921. Studies on 'yellow dwarf' disease of soybean. Hokkaido Agr. Expt. Sta. Rpt. 11:47-59 [In Japanese.]

A study of the soybean-cyst nematode is made. He named the disease "Soybean Yellow Dwarf Disease" because of the yellowish discoloration of the diseased plants.

168. IWADARE, S., M. SASAHI, and N. NAITO. 1943. [A list of these diseases of cultivated plants in Manchuria] Manchuria Natl. Agr. Expt. Sta. Rpt. 45:1-223 [In Japanese.]

The diseases of soybean are described, and among these diseases listed is one caused by Heterodera schachtii.

169. IWATA, K. 1941. A basic test on the control of "Yellow Dwarf" disease of soybean by rotations. Noygo-oyobi-Engei. 16(3): 429-435. [In Japanese.]

Five- and 6-year rotation systems such as sugarbeet-wheat-corn-potato-soybean croppings or flax-oat-pea-corn-soybean for a 5-year rotation system were found almost perfect for obtaining good yields of soybean and for starving cyst nematodes.

170. JENKINS, L. 1963. Nematode research from 1956-1962 in Missouri. Mo. Res. Bul. 883, pp. 14-17.

Meloidogyne incognita var. acrita and Heterodera glycines are problems facing soybean growers. Treatments with a nematicide gave good control of nematodes. A study was made of date of planting.

171. JENKINS, W. R., B. W. COURSEN, R. A. ROHDE, and D. P. TAYLOR. 1956. Occurrence of cyst nematodes, Heterodera spp. in Maryland. U.S. Dept. Agr. Plant Dis. Rptr. 40(10):869.

Cyst nematodes (Heterodera) were found in 29.6 percent of 260 farm samples. There was no evidence that these cyst nematodes were parasitizing soybeans although no other plants were present in the area samples.

172. JENKINS, W. R., D. P. TAYLOR, R. A. ROHDE, and B. W. COURSEN. 1957. Nematodes associated with crop plants in Maryland. Univ. Md. Bul. A-89, 25 pp.

In a survey conducted in Maryland, the following nematode genera and species were associated with soybeans: Aphelenchoides; Aphelenchus; Hoplolaimus coronatus; Helicotylenchus nannus, H. erythrinae; Pratylenchus spp., P. pratensis, P. brachyurus, P. penetrans, P. hexincisus; Ditylenchus spp., Tylenchorhynchus claytoni; Psilenchus; Tylenchus; Heterodera schachtii-group, H. cacti-group; Meloidogyne incognita acrita; Criconemoides spp., Paratylenchus spp., P. projectus; Xiphinama americanum; Longidorus sp., Trichodorus; Neotylenchus; Nothotylenchus; and Dorylaimus.

173. JOHNSON, A. W., and C. J. NUSBAUM. 1967. The activity of Tylenchorhynchus claytoni, Trichodorus christiei, Pratylenchus brachyurus, P. zeae and Helicotylenchus diphystera in single and multiple inoculations on corn and soybean. Abstracts of Papers Presented at the Ann. Soc. of Nematologists Meeting, Washington, D.C., Aug. 20-24, 1967. p. 14.

Population dynamics of three species of nematodes were studied on five varieties of soybeans.

174. JOHNSON, H. W. 1954. Diseases of soybeans and their control. U.S. Dept. Agr. Cir. 931, 40 pp.

A discussion of four species and one variety of root-knot nematodes and the importance, symptoms, and methods of control is included.

175. JONES, F. G. W. 1960. Observations on the beet eelworm and other cyst-forming species of Heterodera. Ann. Appl. Biol. 37(3): 407-440.

176. KATSUFUJI, KOICHI, 1919. "Yellow Dwarf," a new nematode disease of soybean. Ann. Phytopath. Soc. Japan 1(2):12-16.

The symptoms of the disease are described and the pathogen is attributed to Heterodera schachtii. Kidney and adzuki beans are also subject to attack.

177. KLOSS, G. R. 1960. Catalogo de nematoides fitofagos do Brasil [Catalogue of phytophagaus nematodes of Brazil.] Bol. Fitossanitario (Brazil) 8:1-26.

Xiphinema americanum, Helicotylenchus nannus, Ditylenchus dipsaci, Pratylenchus spp., and Aphelenchoides parietinus were found around roots of soybeans in Sao Paulo.

178. KNIERIM, J. A. 1963. Nematodes associated with crop plants in Michigan. Quart. Bul. Mich. Agr. Expt. Sta. 46(2): 254-262.

Nematodes in the genera Heterodera, Hoplolaimus, Pratylenchus, Paratylenchus, Tylenchorhynchus, Tylenchus, and Xiphinema were found in two soil samples collected from soybean fields in Michigan.

179. KOMIYA, SHONOSUKE, and KAORU KUDO. 1960. [Studies on the control of soybean yellow dwarf caused by cyst nematode. I. Control by Chemicals - (DD).] Maiji Univ. Faculty Agr. Bul. (Tokyo) 10:22-24.

180. ______ and KAORU KUDO. 1961. Studies on the control of adzuki bean yellow dwarf caused by cyst nematode (Preliminary report). Jeiji Univ. Faculty Agr. Bul. (Tokyo) 12:27-29.

181. ______ and KAORU KUDO. 1961. Studies on the control of soybean yellow dwarf caused by cyst nematode. Varietal differences of resistance to soybean yellow dwarf (1). Meiji Univ. Faculty Agr. Bul. (Tokyo) 12:31-36 [In Japanese.]

Studies on varieties made during 1958-60.

182. ______ and KAORU KUDO. 1963. Studies on the control of soybean yellow dwarf caused by the soybean-cyst nematode; control by chemical (D-D). Meijidaigaku Kagokugi-jutsukenkyusho Kiyo 15:1-6.

Tests were conducted to study the effect of D-D for controlling the yellow dwarf disease of soybeans. Treated plots had obtained about six-fold yields compared with those of untreated plots

183. ______ and T. YAEGASHI. 1964. Studies on the control of soybean yellow dwarf caused by cyst nematode, Heterodera glycines. 1. Meijidaigaku Nogakubu Kenkyuhokoku 17:1-3.

Effect of EDB (ethylene dibromide) on "yellow dwarf" disease of soybean was studied. Highest yields were obtained where EDB was used.

184. ______ and T. YAEGASHI. 1964. Studies on the control of soybean yellow dwarf caused by cyst nematode, Heterodera glycines. 2. Mejidaigaku Nogakubu Kenkyuhokoky 17:5-7.

Differences in resistance of soybean varieties to "yellow dwarf" were determined. Tohoku-No. 6 did not suffer as much as those of other varieties in the test and its yields were higher.

185. KRUSBERG, L. R. 1959. Investigations on the life cycle, reproduction, and feeding habits and host range of Tylenchorhynchus claytoni. Stiner. Nematologica 4(3):187-197.

Soybean was a fair host of Tylenchorhynchus claytoni.

186. KUWAYAMA, S. 1926. The principal insects of the soybeans in Hokkaido. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 39:1-94. [In Japanese.]

The cyst nematode on soybean is probably Heterodera schachtii or a biological strain of it.

187. LAINER, T. J. 1960. Identification and distribution of the the cyst-forming species of Heterodera with emphasis on the soybean-cyst nematode, Heterodera glycines. Control Plant Board Ann. Meeting. Columbus, Ohio. 1960.

The paper discusses morphological characteristics and distribution of species in the genus Heterodera. The life history and distribution of Heterodera glycines are discussed.

188. LAUTZ, W. H. 1959. Increase of Belonolaimus longicaudatus on various plant species in artifically inoculated soil. U.S. Dept. Agr. Plant Dis. Rptr. 43(1):48-50.

Belonolaimus longicaudatus increased on CNS 24 soybean in the greenhouse.

189. LAVIOLETTE, F. A. 1967. How to control soybean diseases. Farm Technol. 23(1):38-40a.

The author discusses diseases caused by nematodes. These include the root-knot, soybean-cyst, and sting nematodes. The author mentions that other nematodes parasitize soybean roots.

190. LINFORD, M. B. 1960. The soybean-cyst nematode problem. Rpt. Plant Dis., Dept. Plant Pathol., Univ. Ill. 501, 4 pp.

The soybean-cyst nematode, Heterodera glycines, was found first in Illinois in 1959. The history, importance, life history, host plants, and control of the soybean cyst nematode are discussed briefly. Detection of the nematode in the field as related to symptom expression is also discussed. Instructions are included for reporting possible soybean-cyst nematode infestations to State and Federal agencies.

191. LING, LEE. 1951. Bibliography of soybean diseases. U.S. Dept. Agr. Plant Dis. Rptr. Sup. 204, pp. 110-173.

Many references refer to papers on nematodes of soybeans. Most of these are included herein.

192. LORDELLO, L. G. E. 1951. Xiphinema campinense, noua especie (Nematoda Dorylamidae). Bragantia 11:310-311. Portuguese with English summary.]

New species from soybean are reported.

193. ______ 1955. Nematode attacking soybean in Brazil. (Abs.) Phytopathology 45(8):465.

Root-knot and lesion nematodes are serious problems in soybean production.

194. ______ 1955. Nematodes attacking soybean in Brazil. U.S. Dept. Agr. Plant Dis. Rptr. 39(4):310-311.

One of the most serious detriments to soybean cultivation in the state of Sao Paulo, Brazil, is infection by root-knot and lesion nematodes.

195. ______ 1956. Meloidogyne inornata sp. n., a serious pest of soybean in the state of Sao Paulo, Brazil (Nematoda, Heteroderidae). Riv. Brasil. Biol. 16(1):65-70.

A new species of root-knot nematode, Meloidogyne inornata, is described from Sao Paulo, Brazil. It attacks soybean varieties in general, but the variety La 41-1219 is resistant.

196. ______ 1956. Nematoides gue parasitism a soja na regiao de Bauru. Bragantia 15(6):55-64.

Two soybean varieties were grown at Bauru, and three nematodes were involve: lesion nematode (Pratylenchus sp.), and two root-knot nematodes (Meloidogyne incognita (Kofoid & White, 1919) Chitwood, 1949 and M. javanica bauruensis n. sub sp.). Contrary to earlier reports, variety La 41-1219 proved to be resistant to nematodes related to M. incognita. In Bauru, this variety was severely attacked by M. incognita. M. javanica bauruensis attacked variety Abura. Host preference was specific and marked. Lesion nematodes attacked both varieties. A detailed description of M. javanica bauruensis n. sub sp. is included. Some data about the M. incognita population obtained in associations with M. javanica bauruensis are also presented.

197. LORDELLO, L. G. E. 1957. Two new nematodes found associated with soybean roots. Nematologica 2(1):19-24.

Two new nematode species, Caracharolaimus formosus and Dorylaimus bauruensis, are described from around roots of soybean heavily disfigured and decaying from root-knot damage.

198. ______ and A. P. L. ZAMITH. 1958. Nematodeos que prejudicam as cultures de soja e do algodoeiro no Estado de S. Paulo e sua interferencia nos planos de rotacao. Rev. di Agr. 33(3):161-167. [In Portuguese with English summary.]

The paper reports damage by Pratylenchus steineri to soybeans grown in rotation with cotton.

199. LUC, MICHEL. 1959. Nematodes parasites ou soupconnes de parasitisme evers les plantes de Madagascar. Madagascar Inst. de Rech. Agron. Bul. 3:89-102.

Soybeans were heavily attacked by Meloidogyne javanica.

200. LYON, H. L. 1911. Some problems in green soiling with additional notes on bean varieties. Hawaii.Planters Rec. 5:200-210.

Varieties of legumes including four varieties of soybean (Glycines hispida) were evaluated for adaptability to Hawaiian conditions in a field infested with a fungus and with Heterodera radicicola.

201. McCLINTOCK, J. A. 1922. Report on resistant plants for root-knot nematode control. Ga. Agr. Expt. Sta. Cir. 77, 4 pp.

The Biloxi, Laredo, and Otootan soybeans show considerable resistance to root knot.

202. McKIE, J. W., and K. L. ANDERSON. 1967. The Soybean Book. 196 pp. State College, Miss.

The authors discuss nematodes of soybeans with most emphasis on the soybean-cyst and root-knot nematodes.

203. MAI, W. F., H. W. CRITTENDEN, and W. R. JENKINS. 1960. Distribution of stylet-bearing nematodes in the Northeastern United States. N.J. Agr. Expt. Sta. (Rutgers) Bul. 795, 62 pp.

Many stylet-bearing nematodes were associated with soybeans in the Northeastern United States.

204. MALLOCK, W. S. 1923. The problem of breeding nematode resistant plants. Phytopathology 3:436-450.

Soybean was found to be infected by Heterodera radicicola.

205. MALO, S. E. 1964. A review of plant breeding for nematode resistance. Soil and Crop Sci. Soc. Fla. Proc. 24:354-365.

A brief discussion is presented concerning the initial work in the development of soybean varieties resistant to Heterodera glycines.

206. MANKAU, G. R., and M. B. LINFORD. 1956. Soybean varieties tested as hosts of the clover-cyst nematode. U.S. Dept. Agr. Plant Dis. Rptr. 40(1):39-42.

The Illinois population of the clover-cyst nematode entered the roots of all varieties of soybeans tested. They failed to develop in large numbers. None of the varieties can be regarded as a suitable host for the Illinois population of the clover-cyst nematode.

207. MARTIN, G. C. 1955. Plant and soil nematodes of the Federation of Rhodesia and Nyasaland. Preliminary investigations. Nematodes catalogued under hosts or associated plants. Rhodesia Agr. J. 52:346-361.

Variety S.E.S. No. 6 was heavily infected with Meloidogyne javanica.

208. ______ 1961. Frequency of occurrence of genera of plant-parasitic nematodes in soil samples from the Federation of Rhodesia and Nyasaland. Rhodesia Agr. J. 58:322-323.

Aphelenchoides sp., Ditylenchus sp., and Meloidogyne javanica reported from roots of soybeans. Root-knot nematodes caused severe damage.

209. MARTIN, W. J. 1956. Propagation and pathogenicity of Trichodorus sp. on cotton and other crops in Louisiana. (Abs.) Phytopathology 46(1):20.

Studies were made of the propagation and pathogenicity of an undescribed species of Trichodorus on cotton, corn, sweet potatoes, and soybeans. The nematode reproduced abundantly on pelican soybean.

210. MARTIN, W. J. and WRAY BIRCHFIELD. 1955. Notes on plant-parasitic nematodes in Louisiana. U.S. Dept. Agr. Plant Dis. Rptr. 39(1):3-4.

Several plant-parasitic nematodes were recovered from soil collected around soybean plants.

211. MATHENY, W. H. 1960. The soybean-cyst nematode; a new Virginia pest. Va. J. Sci. 11(14):161-162.

The cyst nematode occurs on 3,000 acres, and 53 farms are infested. The current program objectives are to contain the nematode, discourage planting of host crops, and keep trade channels open through certification.

212. MATSON, A. L., and L. F. WILLIAMS. 1965. Evidence of a fourth gene for resistance to the soybean-cyst nematode. Crop Sci. 5:477.

Data presented suggest that in addition to three recessive genes already reported, a dominant allele closely linked with the I locus for seedcoat color is also necessary for resistance.

213. MATSUMOTO, S., and H. SAWAHATA. 1966. Effects of attacks by the root-knot nematode on the yield of soybean. Kyushu Agr. Res. 28:82-83.

This report presents the results of soil fumigation experiments conducted in 1964 in soybean fields where the population density of root-knot nematode was high.

214. MILLER, A. S. 1941. El reconocimiento de las enfermendades de las plantos cultivades en Venezuela, 1937-1941. Soc. Venezolana de Cien. Natl. Bul. 7:99-113.

Heterodera marioni reported on soybean in Venezuela.

215. MILLER, H. N. 1964. Interactions of nematodes and other plant pathogens. Soil and Crop Sci. Soc. Fla. Proc. 24:310-325.

This article is a literature review dealing with the common plant-parasitic nematode genera and their association with other disease organisms. Specifically, mention is made of soybean seedlings. Decreased emergence occurred when Meloidogyne hapla and M. javanica were associated with Rhizoctonia solani. Together M. hapla and Phytophthora sojae produced more severe symptoms on soybeans than either pathogen alone. A brief discussion is presented concerning reduced nodulation on soybeans grown in soil infested with Heterodera glycines.

216. MILLER, L. I. 1965. Variation in development of eleven isolates of Heterodera glycines on Beta vulgaris (Abs.) Phytopathology 55(10):1068.

Isolates of the soybean-cyst nematode from four farms in Virginia and from one farm in each of seven other States were tested to determine their ability to develop gravid females on Detroit Red garden beet.

217. ______ 1966. Maturation of females of Heterodera glycines as influenced by inoculum level. (Abs.) Phytopathology 56(6):585.

On all varieties tested, a greater number of larvae penetrated the roots as the inoculum level was increased. There was progressively poorer root development on all the soybeans tested as the inoculum level was raised.

218. ______ 1966. Variation in development of two morphologically different isolates of Heterodera glycines obtained from the same field. (Abs.) Phytopathology 56(6):585.

Two isolates of the soybean cyst nematode that differ in the length of the hyaline tail terminus of the second-stage larva were tested to determine their ability to develop gravid females on Lee soybean and Ablahoma-12 Mungbean.

219. ______ 1967. Comparison of the pathogenicity and development of the Va. 2 isolate of Heterodera glycines on Pickett and Lee soybeans. (Abs.) Phytopathology 57(7):647.

The pathogenicity and development of 11 isolates of the soybean-cyst nematode (Heterodera glycines) were tested against Pickett and Lee soybeans. The Virginia isolate (Va. 2) was the only isolate pathogenic on Pickett soybean. All isolates were pathogenic on Lee soybean. Fewer cysts of the Va. 2 isolate developed on Pickett than on Lee soybean, but there was no significant difference in size of the cysts and eggs or in number of eggs per cyst formed on the two hosts.

220. MILLER, L. I. 1967. Development of 11 isolates of Heterodera glycines on six legumes. (Abs.). Phytopathology 57(7):647.

Isolates of Heterodera glycines from four farms in Virginia (Va. 1, Va. 2, Va. 3, and Va. 4) and from one farm in each of seven other States (N.C. 1; Va. 1; Ill. 1; Ark. 1; Tenn. 1; Miss. 1; and Ky. 1) were tested for their ability to develop egg-bearing females on six different legumes. The Va. 1, Va. 4, Ark. 1, Ill. 1, and Ky. isolates did not develop on any of the legumes; N.C. 1 did not develop on Trifolium procumbens; Va. 3 and Tenn. 1 on T. incarnatum; Va. 3 on T. hybridum; N.C. 1 and Miss. 1 on Melilotus hispida; Va. 2, Mo. 1, and Miss. 1 on M. orabica; and Miss. 1 on Glycine javanica. This is the first report on these legumes as hosts of the H. glycines.

221. ______ 1967. Pathogenicity and development of the Tennessee isolate of Heterodera glycines on Antirrhinum majus. Abstract of Papers Presented at the Soc. of Nematologists Ann. Meeting, Washington, D.C., Aug. 20-24, 1967, p. 16.

A study of 11 isolates of H. glycines on snowflake snapdragon was made. Variations were found in the rate of reproduction but the Tenn. 1 isolate developed greater numbers of cysts than the other isolates. The Miss. 1 and Ill. 1 isolates did not form cysts on snapdragon. The morphology of the cysts of the various isolates on snapdragon was also studied.

222. ______ and P. L. DUKE. 1967. Morphological variation of eleven isolates of Heterodera glycines in the United States. (Abs.). Nematologica 13(1):145-146.

Some isolates of the soybean-cyst nematode from four farms in Virginia and from one farm in each of seven other States were tested to determine their ability developed freely on Lee soybean.

223. MINTON, E. B., A. L. SMITH, and E. J. CAIRNS. 1960. Population build-up and pathogenicity of reniforms, root-knot, lance, and spiral nematodes on cotton, soybean, and tomato in field bins. (Abs.). Phytopathology 50(8):576.

224. MINTON, N. A., and E. J. CAIRNS. 1957. Suitability of soybeans var. Ogden and 12 other plants as hosts of the spiral nematode. (Abs.) Phytopathology 47(5):313.

Helicotylenchus nannus was not visibly pathogenic on all plants tested except soybean variety Ogden.

225. MINTON, N. A., E. J. CAIRNS, E. B. MINTO, and B. E. HOPPER. 1963. Occurrence of plant-parasitic nematodes in Alabama. U.S. Dept. Agr. Plant Dis. Rptr. 47(8):743-745.

Nine genera of plant-parasitic nematodes were found associated with soybeans.

226. MINZ, GERSHON. 1953. Plant parasitic nematodes. Min. Agr., Agr. Res. Sta., Rehovot, Israel. 38 pp. [In Hebrew with English summary.]

Meloidogyne spp. reported in Israel on Creole, Laredo, and Malaga soybeans.

227. ______ 1958. Root-knot nematodes, Meloidogyne spp. in Israel. Israel Min. Agr., Div. Plant Path., Spec. Bul. 12, 10 pp.

Meloidogyne spp. reported on soybean varieties Creole, Laredo, and Malaga.

228. MIURA, M. 1930. Diseases of the main agricultural crops in Manchuria. Rev. ed. Manchuria Agr. Expt. Sta., Manchuria Railway Co. Bul. 11, 56 pp. [In Japanese.]

The symptoms, causes, and control measures are given for the soybean diseases, including the disease caused by Heterodera schachtii.

229. MIYASAKA, SHIRO. 1954. Soybean improvement. I. Preliminary observations on the behavior of some soybean varieties in Sao Paulo, Brazil. Bragantia: 14:9-17. [In Portuguese with English summary.]

230. MORSE, W. J. 1927. Soybeans: Culture and Varieties. U. S. Agr. Farmers' Bul. 1520, 34 pp.

Heterodera radicicola causing root knot is described. The variety Laredo was resistant. Root knot often causes considerably injury to soybean in many parts of the Southern States.

231. MOUNTAIN, W. B. 1954. Studies of nematodes in relation to brown root rot of tobacco in Ontario. Canad. J. Bot. 32:737-759.

The effect of previous crops upon growth of tobacco and populations of Pratylenchus was studied in brown root-rot investigations in Ontario. When tobacco was grown in Harrow Sandy Loam after 6 years of soybeans, 346 Pratylenchus per gram of tobacco root were found. This was a mixed population of Pratylenchus minyus and the clover Pratylenchus. Growth data for tobacco after soybeans could not be included because of the occurrence of blue mold.

232. MUKASA, KOZO, and MINORU ICHINOHE. 1952. A study of the nematode-disease index to soybean varieties using the relative index system. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 63:117-120.

In studies to determine the difference in susceptibility of 14 soybean varieties, the relative index system proposed by Smith and Taylor for root-knot nematodes was used. This system was considered applicable to studies with this nematode and statistically significant differences in susceptibility were found for the varieties tested..

233. MULVEY, R. H. 1959. Susceptibilities of plants to clover-cyst nematodes, Heterodera trifolii and the period required to complete life cycle. Nematologica 4:132-135.

Inoculated soybeans were not susceptible to H. trifolii.

234. NAKATA, K., and H. ASUYANA. 1938. Survey of the principal diseases of crops in Manchuria. Bur. Indus. Rpt. 32:166 [In Japanese.]

The soybean-cyst nematode was found in Manchuria. Resistance to the nematode in variety Kung No. 557 had occurred, but other varieties had no resistance.

235. NOBLE, R. J., H. J. HYNES, F. C. McCLEERY, and W. A. BIRMINGHAM. 1935. Plant diseases recorded in New South Wales. Dept. Agr. New South Wales Sci. Bul. 46, pp. 3-47.

Heterodera marioni is listed as causing root rot on soybeans.

236. NORMAN, A. G. 1963. The soybean. 23 pp. Academic Press, New York.

The author discusses several nematode problems of soybean.

237. OKADA, TOSHITSUGU. 1965. Studies on the parasitic distribution of the parasities and root development of soybeans. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 87:74-86.

In general, the more roots there were the greater the numbers of parasites. Soil infested from the surface to 15 cm. deep contained greater numbers of the parasites than nematode-infested top soil turned under to a depth of 30 cm., but plant growth was not bad. Therefore, it could not be determined on the basis of these experiments whether turning over the nematode-infested soil in a field would have a good effect on the growth of soybean plants or not.

238. OKADA. TOSHITSUGU. 1965. Studies on the parasitic distribution of nematodes. 2. The growth of soybean roots and the parasitic distribution of soybean-cyst nematodes. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 88:28-37.

This experiment was conducted as one of a series to determine the relationship between the parasitic distribution of the soybean-cyst nematode, Heterodera glycines, and the growth of soybean roots.

239. ______ 1966. Studies on the parasitic distribution of nematodes. 3. Effects of amounts of fertilizer on the growth of soybeans and the parasitic distribution of soybean-cyst nematodes. Hokkaido Nat. Agr. Expt. Sta. Res. Bul. 89:30-36.

In soil infested with high Heterodera glycines populations (165 cyst/100 g. of dry soil) growth of soybeans was poor, and the leaves became yellowish about 50 days after sowing. The amount of damage was decreased by increasing the amount of fertilizer used. Seventy days after sowing, the roots were necrotic, and root development was slight compared with that of normal roots. Some of the new roots, however, proliferated with an increase in fertilizer quantity. The improvement in growth brought about by increased fertilization was more pronounced in plants from soils with high nematode populations than in plants from soils with low nematode populations. Although the application of higher amounts of fertilizer gave better growth and yield of soybeans, it also raised the level of the cysts in the soil.

240. ______ and TSURO MORI. 1963. Studies on the diffusion of soil fumigants. Pt. I. Diffusion pattern of DD mixture and its killing range for soybean-cyst nematode, Heterodera glycines in soil. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 82:1-7.

DD mixture was applied and tested for its diffusion pattern in Tokachi volcanic ash soil infested with the soybean-cyst nematodes.

241. ______ and TSURO MORI. 1964. Studies on the diffusion of soil fumigants. Pt. II. Effect of injection depth on the diffusion pattern of a D-D mixture and its killing range for soybean-cyst nematodes. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 83:24-31. [In Japanese with English summary.]

In order to determine its effective injection depth in Tokachi volcanic ash soil, 3 cc. of a D-D mixture was injected 5, 10, and 15 cm. below the surface. The diffusion pattern of the D-D mixture and its killing range were investigated at each depth by measuring the concentration of chlorine dispersed from the injection point and by three methods of counting the number of viable soybean-cyst nematodes.

242. OOSTENBRINK, M. 1951. Het Erwtencystenaaltje, Heterodera gottingiana Liebscher, in Nederland. Tijdschr. over Plantenziekten 57(2):52-64. [English summary.]

The Dutch pea root eelworm infests peas, broad beans, vetches, and lentils, but red clover, kidney beans, and lupins are not susceptible. The Dutch clover root eelworm infests red clover, white clover, and some other Leguminosae, but not peas. Lucerne and soybeans, which are attacked in the U.S.S.R. and Japan, proved susceptible; thus, there must exist other Heterodera strains attacking the Leguminosae.

243. ______ 1960. The genus Heterodera. In Nematology, J. N. Sasser and W. R. Jenkins, editors. Chapter 18, pp. 206-211. Chapel Hill, N.C.

This extensive paper on the Heterodera species has a key for identification of the species; the key is based on mature cysts and their contents. A table lists the species of Heterodera, type host, and plant families damaged by each.

244. ______ 1961. Nematodes in relation to plant growth. II. The influence of a crop on the nematode population. Netherlands J. Agr. Sci. 9(1):55-60.

Population studies in three rotation trials demonstrated the marked influence of cropping on nematode populations in cultivated soils. Nine special host-parasite relationships are apparent and are summarized in tables.

245. OWENS, JOHN V. 1951. The pathological effects of Belonolaimus gracilis on peanuts in Virginia. (Abs.) Phytopathology 41(1):29.

Belonolaimus gracilis was found attacking soybean crops near Holland. Va.

246. OZAKI, KAORU, and KAZUO ASAI. 1963. Studies on the rotation systems. II. The relationships between crop sequence and the soybean-cyst nematode population in the soil. Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 81:11-21. [In Japanese with English summary.]

247. PALM, E. W., JOE SCOTT, L. A. DUCLOS, and VIRGIL LUEDEERS. 1968. The soybean-cyst nematode. Sci. and Technol. Univ. Mo. Expt. Div. 4 pp.

A general treatment is given of field symptoms, spread, hosts, quarantine regulations, and control methods.

248. PARRIS, G. K. 1940. A check test of fungi, bacteria, nematodes, and viruses occurring in Hawaii, and their hosts. U.S. Dept. Agr. Plant Dis. Rptr. Supl. 121 pp.

Reports Heterodera marioni and Pratylenchus pratensis on Glycine soja in Hawaii. Also lists predaceous nematodes.

249. PEACOCK, F. C. 1956. The reniform nematode in the Gold Coast. Nature 177:489.

Soybean (Glycine max) was a host that allowed the reniform nematode to reproduce at three sites in the Gold Coast, Ghana.

250. ______ 1956. The reniform nematode in the Gold Coast. Nematologica 1(4):307-310.

Eight new host records for the reniform nematode (Rotylenchulus reniformis) were compiled near and around Accra, Gold Coast, Ghana. The life cycle of this nematode on soybean was as short as or shorter than the minimum of 25 days reported by Linford and Oliveira. Soybean was considered a highly susceptible host.

251. ______ 1957. Studies on root-knot nematodes of the genus Meloidogyne in the Gold Coast. Comparative development on susceptible and resistant host plants.

Development of M. incognita acrita was studied on soybeans, tomatoes, and tobacco.

252. PENDER, M. T. 1957. Soybean-cyst nematode, Heterodera glycines. (Abs.). Proc. Assoc. So. Agr. Workers, 54th Ann. Conv. p. 142.

The distribution of the soybean-cyst nematode and quarantine regulations for the prevention of spread is given.

253. PERRY, V. G., and R. S. MULLIN. 1967. The soybean-cyst nematode. Fla. Agr. Ext. Serv., Plant Protect. Pointers, Ext. Plant Path. 9, [Mimeograph ed.].

The soybean-cyst nematode (Heterodera glycines) was identified in Florida for the first time. Symptoms, life cycle, history, and control of the pest are discussed.

254. PETERSON, E. A., and H. KATZNELSON. 1964. Occurrence of nematode-trapping fungi in the rhizosphere. Nature 204(4963):1111.

Nematode-trapping fungi in the sovbean rhizosphere and reduction of nematode populations are discussed.

255. PIPER, C. V., and W. J. MORSE. 1923. The Soybean. 329 pp. McGraw-Hill, New York and London.

Two different nematodes cause injury to the roots of soybeans and reduce the crop considerably. Root knot caused by the nematode Heterodera radicicola often causes considerably injury to soybeans in many par⁺ᵗ of the Southern States where this pest is prevalent. In areas where the pest has become well established, only resistant varieties should be planted. Planting susceptible varieties is dangerous, not only because the bean crop will be reduced but also because the pest can reproduce freely and greatly damage susceptible crops that follow the soybeans. Laredo and three other unnamed varieties are resistant to both the nematode and wilt.

256. POTTER, J. W., and J. A. FOX. 1965. Hybridization of Heterodera schachtii and Heterodera glycines. Phytopathology 55(7):800-801.

Hybridization between H. schachtii and H. glycines was obtained in an attempt to study inheritance of parasitism.

257. RADZIWINOWICZ, J. 1963. Niektore zagadnienia nicieni rodziny Heteroderidae Skarbiowicz 1947. Inst. Ochrona Roslin (Poznan) 21:209-228. [In Polish with English summary.]

Soybean is mentioned as being a host of Heterodera glycines.

258. REBOIS, R. V., and E. J. CAIRNS. 1968. Nematodes associated with soybeans in Alabama, Florida, and Georgia. U.S. Dept. Agr. Plant Dis. Rptr. 52(1):40-44.

Soil samples were collected from 28 major soybean-producing counties in Alabama, Florida, and Georgia. Nematode species were identified and recorded on the basis of symptoms and occurrence in the samples.

259. ______ W. C. JOHNSON, and E. J. CAIRNS. 1968. Resistance in soybean Glycine max L. Merr, to the reniform nematode. Crop Sci. 8:394-395.

Of eight soybean cultivars tested, Pickett and Dyer were resistant to the reniform nematode, Rotylenchulus reniformis. On Pickett and Dyer, soil counts of reniform nematodes were reduced from an initial 10,000 larvae to less than 500 per pot over a 2.5 month period. Cultivars resistant to root-knot nematodes, Meloidogyne spp., were not resistant to the reniform nematode, but those resistant to the soybean-cyst nematode, Heterodera glycines, were resistant to the reniform nematode. Under the conditions of the test, seed yields of Pickett increased whereas those of Hood decreased when inoculated with reniform nematodes.

260. RIGGS, R. D. 1966. Chemical nature of soybean resistance to the soybean-cyst nematode. Ark. Farm Res. 15(6):7.

The differences in free amino acids and phenolic compounds in roots of resistant and susceptible plants were studied.

261. ______ and M. L. HAMBLEN. 1962. Soybean-cyst nematode host studies in the family Leguminosae. Ark. Agr. Expt. Sta. Rpt. Ser. 110, 18 pp.

In the Leguminosae family, 1,152 entries representing 302 species in 61 genera were inoculated with Heterodera glycines. Three hundred and ninty-nine entries in 23 genera were classified as susceptible, and 270 entries in 12 other genera allowed limited reproduction. Fifty-one new records were recorded.

262. ______ and M. L. HAMBLEN. 1966. Additional weed hosts of Heterodera glycines. U.S. Dept. Agr. Plant Dis. Rptr. 50(1): 15-16.

Most common weeds of Arkansas were tested for susceptibility to soybean-cyst nematode.

263. ______ and M. L. HAMBLEN. 1966. Further studies on the host range of the soybean-cyst nematode. Ark. Expt. Sta. Bul. 718: 19 pp.

Heterodera glycines reproduced on 334 of 677 legumes and 62 of 280 nonlegumes tested. These represented 103 species in 17 genera of legumes and 48 species in 43 genera of nonlegumes.

264. ______ D. A. SLACK, and M. L. HAMBLEN. 1968. New biotype of soybean-cyst nematode. Ark. Farm Res. 17(5):11.

A population of the sovbean-cyst nematode from near Blytheville, Ark., reproduced readily on the Pickett variety. Other populations failed to reproduce on this variety. Authors concluded that a biotype was present that may be similar to the Va.-2 isolate.

265. RIVERA CAMEARENA, J. E. 1964. Pathogenic and biological aspects of sting and lance nematodes. Diss. Abs. 25(1):19.

Soybeans varieties 3734 and Jackson are poor hosts for Belonolaimus longicaudatus and Hoplolaimus coronatus.

266. ROHDE, R. A., and W. R. JENKINS. 1957. Host range of a species of Trichodorus and its host-parasite relationship on tomato. Phytopathology 47(5):295-298.

The increase of Trichodorus on tomato was less than tenfold but it is considered a good host for this nematode. Other crop plants including soybeans were considered excellent host and had more than a tenfold reproduction.

267. ROSS, J. P. 1958. Host-parasite relationship of the soybean-cyst nematode in resistant soybean roots. Phytopathology 48(10): 578-579.

The reactions of susceptible and resistant varieties of soybeans to infection by Heterodera glycines were compared.

268. ______ 1959. Influence of resistance to Heterodera glycines on soybean yield and nematode populations. (Abs.). Phytopathology 49(5):319.

No reproduction of the soybean-cyst nematode occurred on the resistant Peking variety. Influence of Nemagon on resistant and susceptible soybeans is reported.

269. ______ 1959. Interaction of Meloidogyne incognita incognita and Heterodera glycines on soybeans. (Abs.) Phytopathology 49(9):549.

The effects of the two kinds of nematodes in combination on soybeans are compared.

270. ______ 1959. Nitrogen fertilization on the response of soybeans infected with Heterodera glycines. U.S. Dept. Agr. Plant Dis. Rptr. 43(12):1284-1286.

Split applications of nitrogen to plots heavily infested with soybean-cyst nematodes significantly increased yield and nematode populations. Nitrogen fertilization decreased nodulation.

271. ______ 1960. Soybean-cyst nematode control by crop rotation. (Abs.) Phytopathology 50(9):652.

A study of the efficacy of crop rotation in controlling the soybean-cyst nematode disease was made, using 2-, 3- and 4-year rotations.

272. ROSS, J. P. 1960. The effect of soil temperature on development of Heterodera glycines in soybeans. (Abs.) Phytopathology 50(9):652.

Soil temperatures affected development of Heterodera glycines in susceptible soybean roots. The threshold temperature for development was between 10° and 17° C.

273. ______ 1962. Crop rotation effects on the soybean-cyst nematode population and soybean yields. Phytopathology 52(8):815-818.

There were no differences in soybean yields or postseason nematode populations among 2-year rotations involving cowpeas, corn, or cotton.

274. ______ 1962. Physiological strains of Heterodera glycines. U.S. Dept. Agr. Plant Dis. Rptr. 46(11):766-769.

Populations of Heterodera glycines from North Carolina a.. Tennessee were compared for ability to develop on a soybean line that has resistant in Tennessee and susceptible in North Carolina.

275. ______ 1963. Seasonal variation of larval emergence from cysts of the soybean-cyst nematode, Heterodera glycines. Phytopathology 53(5):608-609.

A study under laboratory conditions was made of the rate of larval emergence from cysts of Heterodera glycines during fall, winter, and spring.

276. ______ 1964. Effect of soil temperature on development of Heterodera glycines in soybean roots. Phytopathology 54(10):1228-1231.

Data are presented on the influence of constant and fluctuating, controlled soil temperatures on soybean-cyst nematode development.

277. ______ 1964. Interaction of Heterodera glycines and Meloidogyne incognita on soybeans. Phytopathology 54(3):304-307.

A study was made to determine the effect of single and mixed populations of H. glycines and M. incognita on growth and yield of soybeans and the influence of population levels of the nematode.

278. ROSS, J. P. 1965. Predisposition of soybean to Fusarium wilt by Heterodera glycines and Meloidogyne incognita. Phytopathology 55(3):361-364.

This report presents results of greenhouse and microplot experiments pertaining to the interrelationships of Fusarium wilt with the soybean-cyst and root-knot nematode diseases of soybeans.

279. ______ and C. A. BRIM. 1957. Resistance of soybeans to the soybean-cyst nematode as determined by a double row method. U.S. Dept. Agr. Plant Dis. Rptr. 41(11):923-924.

Approximately 2,800 selections and varieties of soybeans were evaluated for resistance by planting and test line or variety adjacent to a high susceptible variety in field plots.

280. ______ C. J. NUSBAUM, and HEDWIG HIRSCHMANN. 1967. Soybean yield reduction by lesion, stunt, and spiral nematodes. (Abs.) Phytopathology 57(5):463-464.

The effect of Helicotylenchus dihystera, Tylenchorhynchus claytoni, and Pratylenchus brachyurus on yields of Lee soybean was determined for significant yield reduction in 1965, b there was yield reduction in 1966, with Pratylenchus causing greatest osses and Tylenchorhynchus intermediate.

281. RYDER, H. W., and H. W. CRITTENDEN. 1962. Interrelationships of tobacco ringspot virus and Meloidogyne incognita acrita in nematode resistance and susceptible soybeans. (Abs.) Phytopathology 52(11):1220.

A disease interaction between TRSV and root-knot nematodes was not evident on any soybean variety studied.

282. ______ and H. W. CRITTENDEN. 1962. Interrelationship of tobacco ringspot virus and Meloidogyne incognita acrita in roots of soybean. (Abs.) Phytopathology 52(2):165-166.

Microscopic comparisons were made of the histopathology and cytopathology of nematode-infected roots with and without virus.

283. SASSER, J. N. 1952. Identification of root-knot nematodes (Meloidogyne spp.) by host reactions. U.S. Dept. Agr. Plant Dis. Rptr. 36(3):84-86.

Host-range studies were conducted with the five described Meloidogyne species that occur in the United States. Some plant species were highly resistant or immune to one or more of the root-knot species, but may be severely attacked by the other species.

284. ______ 1952. Identification of root-knot nematodes (Meloidogyne spp.) by host tests (Abs.). Phytopathology 42(1):17-18.

Host-range studies were conducted with the five described Meloidogyne species that occur in the United States. Some plant species were highly resistant or immune to one or more of the root-knot species, but may be severely attacked by the other species.

285. ______ 1954. Identification of root-knot nematodes (Meloidogyne spp.) by host reactions. U.S. Dept. Agr. Plant Dis. Rptr. 36(3):84-86.

The paper reports research to determine susceptibility of plant species and behavior of root-knot species in resistant and susceptible plants, including soybeans, and to determine the distribution of these nematodes in Maryland.

286. ______ 1958. Heterodera glycines, the present situation. Proc. of S-19 Workshop in Phytonematology, Univ. of Tenn., July 1-6, 1957.

A general discussion of the soybean-cyst nematode and the research underway in North Carolina is given. It covers distribution, type of damage, losses, host range, and many other important facts about the nematode.

287. ______ 1963. Crop rotation, a good weapon -- soybean-cyst nematode. Res. and Farming (N.C.). 22(2):13.

A serious pest of soybean, the cyst nematode, can be controlled by crop rotation. Tests show that rotation of crops that are not attacked by the nematodes reduces the population rapidly.

288. SASSER, J. N., L. A. NELSON, and H. R. GARRISS. 1965. Quantitative effects of five nematode genera on growth and yield of peanuts, cotton, and soybean following granular nematicide treatments. (Abs.) Nematologica 12(1):98-99.

They evaluated nematicides for the control of nematodes in peanuts, cotton, and soybean. The plots were naturally infested with five kinds of plant-parasitic nematodes.

289. ______ L. A. NELSON, and H. R. GARRISS. 1966. Quantitative effects of five nematode genera on growth and yield of peanuts, cotton, and soybeans following granular nematicide treatments. (Abs.) Nematologica 12(1):98-99.

The effects of nematicides on the control of Xiphinema americanum, Pratylenchus brachyurus, Helicotylenchus dihystera, Criconemoides rusticum, and Belonolaimus longicaudatus on peanut, cotton, and soybean plantings are reported.

290. ______ and G. UZZELL, JR. 1960. Methyl bromide fumigation of Heterodera glycines in North Carolina. U.S. Dept. Agr. Plant Dis. Rptr. 44(9):728-732.

Methyl bromide treatments were developed to eradicate soybean-cyst nematodes in an airtight fumigation chamber. Dosage levels and temperature studies were made.

291. ______ and G. UZZELL, JR. 1963. Control of the soybean-cyst nematode by crop rotation. (Abs.). Phytopathology 53(6):625.

The effectiveness of 1- and 2-year rotations with a nonhost crop was studied. Nematode populations at time of planting were inversely correlated with soybean yields.

292. ______ and G. UZZELL, JR. 1963. Influence of non-host crops alone or in combination with a nematicide on the longevity of the soybean-cyst nematode in the soil. (Abs.). Phytopathology 53(6):625.

293. SATO, A. and H. KOMORI. 1964. Research on Heterodera glycines. Soc. Plant Protect. N. Japan, Ann. Rptr. 15:139-141. [In Japanese.]

P.I. 84751 and three Japanese varieties were studied.

294. SAYRE, R. M., and W. B. MOUNTAIN. 1962. The bulb and stem nematode (Ditylenchus dipsaci) on onion in southwestern Ontario. Phytopathology 52(6):510-516.

Soybean was classed as immune to D. dipsaci.

295. SCHEETZ, R. W., and H. W. CRITTENDEN. 1966. Histochemistry of soybean varieties resistant or susceptible to Meloidogyne in incognita acrita. (Abs.) Phytopathology 56(6):586.

Within the Lysigenomata there is a higher concentration of lipids present in the susceptible varieties (Adams and Virginia) than in the resistant variety (Delmar).

296. SCHILKE, P. J., and H. W. CRITTENDEN. 1959. Host-parasite relationships of soybean and a root-knot nematode Meloidogyne hapla. (Abs.) Phytopathology 49(8):525.

Galls first appeared on variety Adams at 7 days and on Laredo and Anderson soybeans at 14 days. Egg masses were first found on Adams and Anderson at 35 days and on Laredo at 42 days.

297. SCHINDLER, A. F. 1954. Root galling associated with dagger nematode, Xiphinema diversicaudatum. (Micoletsky, 1927) Thorne, 1939. (Abs.) Phytopathology 44(7):389.

Galls or curly tips were produced on the roots of seedlings of tomato, soybean, okra, cucumber, balsam, and peanut grown in X. diversicaudatum infested soils. The nematodes were observed and photographed in the process of feeding on the roots of soybeans.

298. ______ 1957. Parasitism and pathogenicity of Xiphinema diversicaudatum, an ectoparasitic nematode. Nematologica 2(1):25-31.

X. diversicaudatum was observed apparently feeding on soybean roots, Glycine max, variety Bansei. . This nematode causes "curly-tip" roots on hosts tested and is considered a plant parasite.

299. SCHROEDER, P. H., and W. R. JENKINS. 1963. Reproduction of Pratylenchus penetrans on root tissue grown on three media. Nematologica 9(3):327-331.

Experiments on rearing Pratylenchus penetrans on excised roots and callus on various culture media were reported. Soybean roots grew well, but nematode reproduction was low.

300. SHANDS, W. A., and H. W. CRITTENDEN. 1957. The influence of nitrogen and potassium on the relationship of Meloidogyne incognita acrita and soybeans. (Abs.) Phytopathology 47(7):454.

In the presence of legume bacteria, the amount of nematode galls on Adams and penetration of Anderson by larvae is increased.

301. SHAW, K. J. 1940. The effect of crop rotation on the control of Heterodera marioni on Norfolk sandy loam. (Abs.) Phytopathology 30(8):710.

In a crop rotation experiment to control Heterodera marioni, tobacco following 'Laredo' soybeans showed 69.8 percent infection.

302. SILVA, J. G., da, L. G. E. LORDELLO, and SHIRO MIYASAKA. 1952. Observacoes sobre a resistancia de algumas variedades de soja ao nematoide das Galhas. Bragantia 12(1/3):59-63.

Varieties Abura, Rio Grande, 455, Chosen, Georgia, Pereira Barreto, Arksoy, and Acadian have shown severe attacks bv two forms of root-knot nematodes, both closely related to Meloidogyne incognita (Koford & White, 1919) Chitwood, 1949. N 46-2652, in Southern United States considered a resistant variety, was susceptible to above nematodes in two pot tests. In one field trial, Palmetto, La. 41-1219, N 45-3799, and Ottotan varieties were resistant. In two other tests, using artifically infested plants, varieties Palmetto and La. 41-1219 were resistant.

303. SKOTLAND, C. B. 1956. Life history and host range of the soybean-cyst nematode. (Abs.) Phytopathology 46(1):27.

Mature males were found at 14 days and second-stage larvae at 21 days after inoculation. Reproduction occurred on annual lespedeza, common vetch, soybeans, and snapbean, and adzuki bean.

304. ______ 1957. Biological studies of the soybean-cyst nematode. Phytopathology 47(10):623-625.

Various biological aspects, including host range, life cycle, and effects of desiccation on contents of cysts, were studied.

305. ______ J. N. SASSER, and N. N. WINSTEAD. 1955. Preliminary report of results of research on the soybean-cyst nematode in North Carolina. Ann. Rptr. of Soybean-Cyst Nematode Control, U.S. Dept. Agr. Plant Pest Control Div., pp. 19-33.

Morphological and host-range studies are presented as well as the results of chemical experiments to control the cyst nematode harbored on gladioulus corms and narcissus bulbs.

306. SKOTLAND, C. B., N. N. WINSTEAD, and J. N. SASSER. 1956. The soybean-cyst nematode disease. N.C. Agr. Expt. Sta Ser.. Folder 126, 5 pp.

A description of the soybean-cyst nematode is presented with information on control measures and how the nematode is spread. Five general recommendations are given.

307. SLACK, D. A. 1958. Soybean-cyst nematode. Ark. Farm Res. 7(3):2.

Information is presented on research to provide a better understanding of the biology of soybean-cyst nematodes and effective measures for their control.

308. ______ 1959. Damage to soybeans by the soybean-cyst nematode. Ark. Farm Res. 8(5):2.

A report of studies to assess the damage that might be attributed to the soybean-cyst nematode in the infested areas of Arkansas is given.

309. ______ and M. L. HAMBLEN. 1959. Factors influencing emergence of larvae from cysts of Heterodera glycines Ichinohe. Influence of constant temperature. Phytopathology 49(5):319-320.

Larval emergence from cysts was good between 68° and 90° F.

310. ______ and M. L. HAMBLEN. 1961. The effect of various factors on larval emergence from cysts of Heterodera glycines. Phytopathology 51(6):350-355.

Included is a study of the influence of leachates, temperature, light, desiccation, and incubation on the emergence of larvae from cysts.

311. SMALL, H. G. 1958. Cyst nematode (Heterodera glycines) No. 1 soybean threat. Crops and Soils 11(2):9-10.

Information is presented on the damage to soybeans by the soybean-cyst nematode and the possible hazard of growing soybeans. where the nematode occurs is evaluated.

312. SMART, G. C., JR. 1961. Culture of the soybean-cyst nematode. Va. J. Sci. 12(4):153.

Extraction of cysts from soil cultures with minimum organic debris was studied. Production was best in a 90 percent sand and 10 percent Kaolin-type 41 clay mixture.

313. SMART, G. C., JR. 1962. Distribution of cysts of Heterodera glycines in soil at different depths. (Abs.) Phytopathology 52(1):1221.

The highest population of cysts occurred at a depth of 3-6 inches; numbers of cysts rapidly diminshed at deeper levels. However, a few cysts were found at a depth of 3 1/2 feet.

314. ______ 1963. Survival of encysted eggs and larvae of the soybean-cyst nematode, Heterodera glycines, ingested by swine. (Abs.) Phytopathology 53(8):889-890.

Cysts of Heterodera glycines were fed to swine and recovered. Incubated cysts were added to pots of soybeans to determine survival. A total of 17.8% of the cysts fed were recovered, but no encysted eggs or larvae were found.

315. ______ 1964. Additional hosts of the soybean-cyst nematode, Heterodera glycines, including hosts in two additional plant famalies. U.S. Dept. Agr. Plant Dis. Rptr. 48(5):388-390.

Ten additional host species of the soybean-cyst nematode were discovered, including hosts in two plant families not previously reported.

316. ______ 1964. Environmental factors affecting nematode injury. Soil and Crop Sci. Soc. Fla. Proc. 24:294-302.

This is a review article covering environmental factors affecting nematode injjry. Specifically, the author discusses the survival of larvae, eggs, and encysted larvae of Heterodera glycines at varying relative humidities. Temperature effects on larval emergency are also discussed. The variety, Peking, as a source of resistance to the soybean-cyst nematode, is also mentioned.

317. ______ 1964. Physiological strains and one additional host of the soybean-cyst nematode, Heterodera glycines. U.S. Dept. Agr. Plant Dis. Rptr. 48(7):542-543.

Two nematode isolates, one from North Carolina and one from Arkansas, exhibited physiological differences and are considered physiological strains of H. glycines.

318. SMART, G. C., JR. 1964. The effect of yield of soybeans infested with the soybean-cyst nematode, Heterodera glycines, from Virginia. (Abs.) Va. J. Sci. 15(4):265.

Bean yield from pots inoculated with 3,812 cysts per pot was 25 percent less than bean yield from uninoculated pots, and stem yield was 31 percent less. Bean yield from nonfumigated soil was 46 percent less than bean yield from fumigated soil.

319. ______ and B. A. WRIGHT. 1962. Survival of the cysts of Heterodera glycines adhering to stored sweetpotato, peanut, and peanut hay. (Abs.) Va. J. Sci. 13(4):219-220.

Larvae in cysts adhering to sweetpotato, peanut, and peanut hay in storage were viable after 12 months under all test conditions, which is longer than the normal storage period for these products.

320. SMITH, A. L., and A. L. TAYLOR. 1947. Field method of testing for root-knot infestation. Phytopathology 37(2):85-93.

Two systems for determining the severity of root-knot infection were compared. One was a root-knot index based on the percentage of the root system with visible galls; the second was a relative root-knot index based on the adoption of standards for each root-knot class with the remainder of the roots graded by comparison with standards selected. In soybean variety tests, Laredo was most resistant, Biloxi and Otootan were intermediate, and Clemson and Georgian were most susceptible to the root-knot nematode, Heterodera marioni.

321. SOMERVILLE, A. M., JR., and U. H. YOUNG, JR. 1956. Review of plant parasitic nematodes found in Virginia during 1955. (Abs.) Va. J. Sci. 7(4):259-260.

During 1955, plant and soil samples from many sections of Virginia were examined. From these samples, nematodes from 14 of 23 known plant-parasitic genera were isolated and identified. The preliminary data accumulated indicate that the scope of the nematode problem is of sufficient importance to warrant a systematic survey.

322. SPEARS, J. F. 1955. Progress report of soybean-cyst nematode control program for calendar year 1955. U.S. Dept. Agr., Agr. Res. Serv., Plant Pest Control Div. 25 pp.

This report deals with the history, distribution, and quarantine regulations of the soybean-cyst nematode, plus the effects of that nematode on the soybean industry. Included are means of spread and suggested control measures.

323. SPEARS, J. F. 1957. The soybean-cyst nematode and your industry. Soybean Digest 17(11):56-59.

Information on the history of the soybean-cyst nematode, means of spread, and suggestions for control are presented.

324. ______ 1959. Current status of the soybean-cyst nematode. Soybean Digest 19(11):58-61.

A general review of the distribution, spread, and use of rotations for control is presented.

325. ______ 1959. The nematode problems. Agr. Chem. 14(2):36-38.

The paper deals with a number of nematodes, including the soybean-cyst nematode.

326. ______ 1961. Latest developments on the soybean-cyst nematode. Soybean Digest 21(11):30-31.

A general review of the soybean-cyst nematode problems with estimates of losses in the infested States is given. Suggestions on control are presented.

327. ______ 1962. Can the soybean cyst be controlled? Soybean Digest 11(1):3 pp.

The paper gives a general appraisal of the soybean-cyst nematode, distribution, acreage infested, and status of the nematode problem. The use of rotations, resistant varieties, and chemical control measures is presented.

328. ______ 1963. Cyst nematode: its status as threat to mid-south beans. Cotton Farming Mag. 7(1):26-28.

A general appraisal of the cyst nematode, a review of the distribution, and some suggestions for control are given.

329. ______ S. C. BALCOMBE, and G. HEMERICK. 1957. Detection of Heterodera glycines in North Carolina. (Abs.). Phytopathology 47(1):33.

Symptoms produced by the soybean-cyst nematode were visible on soybean foliage 6 weeks after planting when the cyst count before planting was 5 to 200 cysts per pound of soil, and symptoms were visible 12 weeks aftering planting when the cyst count was 1 cyst per 10 pounds of soil. Diseases plants were yellow and stunted and appeared as elliptical areas in the field. Roots of infected plants were small and dark, with few or no nodules.

330. SPEARS, J. F., F. I. BOWEN, and C. D. BOWERS. 1956. Soybean-cyst nematode found in new area. U.S. Dept. Agr. Plant Dis. Rptr. 40(9):830.

The soybean-cyst nematode was reported for the first time in the United States near Burgaw, N.C.

331. STANDEN, J. H. 1952. Host index of plant pathogens of Venezuela. U.S. Dept. Agr. Plant Dis. Rptr. Sup. 212:59-106.

Meloidogyne marioni is reported on soybeans.

332. SUGIYAMA, SHINTARS, and HIROMA KATSUMI. 1966. [A resistant gene of soybeans to the soybean-cyst nematode observed from the cross between Peking and Japanese varieties.] Jap. J. Breeding 16:83-86. [In Japanese.]

Peking, a highly resistant variety, was cross reciprocally with incompletely resistant Namashirazu and susceptible Shiromeyutaka. F_2 progencies were tested for resistance, and relationships with some other characters also were examined. Frequencies of the resistant plants were 1/4 for Peking x Nemashirazu and almost 1/16 for Peking x Shiromeyutaka, thus indicating 1 (for the former) or 2 (for the latter) recessive genes concerned with resistance. In these crosses a coupling linkage between the resistance allele and that which determines the expression of seed color (blk or brn) was found. This resistant recessive gene was designated "rhg". [Authors' abstract.]

333. ______ and HIROMA KATSUMI. 1968. Studies on the resistance of soybean varieties to the soybean-cyst nematode. I. Comparison of varietal responses. Jap. J. Breeding. 18(2):16-23. [In Japanese with English summary.]

Resistance of soybeans to the soybean-cyst nematode was tested in two field experiments, and a successive observation was made of the number of cysts and amount of nodulation in pot cultures. With these varieties, two types of resistance, 'Peking' and 'Gedenshiraxu', were classified.

334. TANAKA. T. 1921. On soybean nematodes; preliminary identification. J. Plant Protect. (Tokyo) 8:551-553. [In Japanese.]

The paper describes the morphology of Heterodera schachtii with suggestions for its control.

334. TANAKA. T. 1921. On soybean nematodes; preliminary identification. J. Plant Protect. (Tokyo) 8:551-553. [In Japanese.]

The paper describes the morphology of Heterodera schachtii with suggestions for its control.

335. TAYLOR, A. L. 1942. Root-knot resistance of five soybean varieties. (Abs.) Phytopathology 32(7):650.

A method was devised and used in four experiments at three locations for testing resistance of the soybean varieties Laredo, Biloxi, Otootan, Clemson, and Georgian to the root-knot nematode, Heterodera marioni. Irregularities were obtained, indicating that ecological conditions were important. None of the soybean varieties were resistant enough to use in a nematode-reducing rotation program.

336. _____ 1957. A review of the literature pertaining to the soybean-cyst nematode. U.S. Dept. Agr., Agr. Res. Serv., Nematology Sect. 7 pp.

A review of the history, distribution, life history, host range, biology, habits, and control is presented.

337. _____ 1957. Heterodera taxonomy. Proc. of S-19 Workshop in Phytonematology, Univ. of Tenn., July 1-6, 1957. p. 12.

This paper studies the taxonomic status of the Heterodera. A review of the morphology, life history, cysts, and larvae, and a key to the species are included. A list of principal host plants of each species is given.

338. _____ 1962. The effect of nematicides on crop yields in the United States. Nematologica 7(1):16-17.

From reports within the United States, the average increase in yield of soybeans where plots were treated with a nematicide was 126.1 percent.

339. _____ J. FELDMESSER, and G. FASSULIOTIS. 1952. An improvement in the method of searching for Heterodera cysts. U.S. Dept. Agr. Plant Dis. Rptr. 36(7):269.

A method of separating cysts from soil and methods of staining the cysts to aid in examination are described.

340. TAYLOR, D. P. 1957. Plant-parasitic nematodes: A threat to Minnesota crops. Minn. Farm and Home Sci. 14(3):5, 9.

The lance and spiral nematodes have been found in large numbers on soybeans in Minnesota.

341. ______ 1960. Biology and host-parasite relationships of the spiral nematode, Helicotylenchus microlobus. Diss. Abs. 21(4):721-722.

Eight species of the genus Helicotylenchus were identified in 46 percent of 810 soil samples collected in 1956-59 throughout Minnesota. Members of this genus had the highest frequency of occurrence in the southern, central, and west-central districts of the State. Rye, corn, wheat, oats, soybean, and flax were the crops with which Helicotylenchus spp. were most frequently associated.

342. ______ 1960. Host range study of the spiral nematode, Helicotylenchus microlobus. U.S. Dept. Agr. Plant Dis. Rptr. 44(9):747-750.

In greenhouse pot tests, the following soybean varieties supported population increases of H. microlobus 3 months after inoculation: Acme, Blackhawk, Capital, Chippewa, Comet, Earlyana, Flambeau, Grant, Harosoy, Monroe, Norchief, and Ottawa Mandarin.

343. ______ 1961. Biology and host-parasite relationships of the spiral nematode, Helicotylenchus microlobus. Proc. Helminthol. Soc. Wash. 28(1):60-66.

H. microlobus producted light- to dark-brown lesions on soybean roots. The lesions involved 4-10 epidermal cells and could not be observed to extend more than four cells into the cortest. In about one-third of the lesions observed, the anterior and H. microlobus was embedded in the root. Endoparasitism was not observed in soybean roots as it was in other host plants.

344. ______ 1961. Nematodes can make soil-borne diseases worse. Minn. Farm and Home Sci. 18(3):10, 17.

In soybean experiments where the fungus Rhizoctonia solani and nematodes Meloidogyne hapla and M. incognita alone and the fungus and nematodes in combination were used, the following results were obtained: (1) Emergence of soybeans was drastically reduced when the fungus and nematodes were used in combination; and (2) retardation in growth and post-emergence death of plants were greater when the fungus and nematodes were used in combination.

345. TAYLOR, D. P., R. V. ANDERSON, and W. A. HAGLUND. 1958. Nematodes associated with Minnesota crops. I. Preliminary survey of nematodes associated with alfalfa, flax, peas, and soybeans, U.S. Dept. Agr. Plant Dis. Rptr. 42(2):195-198.

The following nematodes were found associated with soybeans as a result of field surveys in Minnesota: Aphelenchoides spp.; Aphelenchus spp.; Ditylenchus spp.; Helicotylenchus spp.; H. erythrinae; H. nannus; Heterodera spp.; H. cacti-group; Hoplolaimus coronatus; Boleodorus spp. Neotylenchus spp.; Nothotylenchus spp.; Paratylenchus spp.; Pratylenchus spp.; P. hexincisus, P. penetrans, P. pratensis, P. scribneri, Psilenchus spp.; Rotylenchus robustus; Trichodorus spp.; Tylenchorhynchus spp.; T. acutus, T. latus, T. maximus, T. nudus, T. straitus; Tylenchus spp.; and Xiphinema americanum, and nematodes in the genera Helicotylenchus, Tylenchorhynchus, Paratylenchus and Pratylenchus were the most frequently recovered.

346. ______ D. I. EDWARDS, and R. B. MELEK. 1968. The soybean-cyst nematode spreads through Southern Illinois. Ill. Res. Univ. Ill. Agr. Expt. Sta., Fall, 1968.

A general explanation is given of the cyst nematode situation in Illinois, with suggestions for rotations, resistant varieties, and chemical control.

347. ______ J. M. FERRIS, and V. R. FERRIS. 1967. Quantitative study of root development under defined conditions of seedling soybeans inoculated with Pratylenchus penetrans. Abs. of Papers Presented at the Ann. Soc. of Nematologists Meeting, Washington, D.C., Aug. 20-24, 1967. p. 26.

Diagnostic parameters for determining extent of injury to seedling soybeans by Pratylenchus penetrans under defined conditions were established at three temperatures: 16°, 21°, and 27° C.

348. ______ and M. C. SHURTLEFF. 1963. The soybean cyst nematode problem. Coop. Ext. Serv. Rpt. on Plant Dis., Univ. of Ill. 501, 4 pp.

This is a report, primarily for Illinois growers, on the importance, symptomatology and identification, life history, host plants, means of spread, and general control of the soybean-cyst nematode, Heterodera glycines.

349. TAYLOR, D. P., and T. D. WYLLIE. 1959. Interrelationships of root-knot nematodes and Rhizoctonia solani on soybean emergence. (Abs.). Nematologica 13(1):154.

The effect of Meloidogyne javanica and M. hapla alone and in combination with Rhizoctonia solani on preemergence damping-off of Chippewa soybeans was determined in tests at 75° F. in the greenhouse. Three weeks after planting in steamed soil, the average emergence for each treatment, expressed as a percentage of the check, was: M. javanica alone, 90%; M. hapla alone, 83%; R. solani alone, 50%; M. javanica plus R. solani, 17%; and M. hapla plus R. solani, 2%.

350. TOMBERLIN, A. H., JR., and V. G. PERRY. 1967. Pathogenicity of Belonolaimus longicaudatus to three varieties of soybean.

Data on plant growth as measured by heights and dry weights, increase of nematode populations, and direct observations of feeding on the roots indicate that B. longicaudatus is a parasite on Lee, Bansei, and Hinson and a pathogen of Lee and Hinson.

351. TRIANTAPHYLLOU, A. C., and H. HIRSCHMANN. 1962. Oogensis and mode of reproduction in the soybean-cyst nematode, Heterodera glycines. Nematologica 7(3):235-241.

Oogensis and mode of reproduction in the soybean-cyst nematode Heterodera glycines were studied in four populations before and during the fourth molt. H. glycines has a normal meiotic cycle and reproduces by cross fertilization.

352. TSUTSUMI, MASAAKI, and KIYOSHI SAKURAI. 1966. Influence of root diffusates of several host and non-host plants on the hatching of the soybean-cyst nematode, Heterodera glycines Ichinohe, 1952. Japan. J. Appl. Ent. and Zool. 10(3):129-137.

Root diffusates of soybean, adzuki bean, kidney bean, and wheat were tested to determine their effect on egg hatching and larval emergence of the soybean-cyst nematode under lab conditions. Host plant leachings and diffusates stimulated hatching, whereas nonhost plant leachings and diffusates did not stimulate hatching.

353. U.S. Department of Agriculture. 1956. Soybean-cyst nematode. U.S. Dept. Agr., Agr. Res. Serv., ARS 22-29, 10 pp.

This is a general report on the soybean-cyst nematode. A description of the nematode, its distribution, hosts, research, quarantine, and the importance of host plants all are presented.

354. U.S. Department of Agriculture. 1960. Soybeans are being bred to resist: Soybean-cyst nematode. U.S. Dept. Agr. Agr. Res. 9(1):12.

Resistant varieties of soybeans are being bred for planting in cyst nematode infested soil. Three recessive genes control resistance. Breeding work is underway in Mississippi, Missouri, North Carolina, and Tennessee.

355. ______ 1961. Rotations help control soybean-cyst nematode. U.S. Dept. Agr. Agr. Res. 10(6):11.

Rotation studies in Tennessee show that good control of the soybean-cyst nematode can be obtained by growing nonhost crops in rotation with soybeans in heavily infested fields. Yields were clearly associated with the number of larvae in the soil at the beginning of the growing seasons.

356. ______ 1961. Soybean-cyst nematode. Progress in research and control. Washington, D.C. U.S. Dept. Agr., Agr. Res. Serv. ARS, 22-72, 20 pp.

This general report covers the soybean-cyst nematode, its occurrence, life cycle, type of damage, hosts, spread, and control. Sections on rotations, soil treatments, resistance, and survey methods are included.

357. ______ 1966. The soybean-cyst nematode. U.S. Dept. Agr. Program Aid 333, 4 pp. (Rev. in 1968.)

This is a general publication on the soybean-cyst nematode: Type of damage, how it lives, how it is spread, detection in field, and control measures.

358. VAN DER LINDE, W. J. 1956. The *Meloidogyne* problem in South Africa. Nematologica 1(3):177-183.

Glycine javanica L. is reported as a host of *Meloidogyne incognita acrita* and *M. javanica*.

359. VAN WEERDT, L. G., WRAY BIRCHFIELD, and R. P. ESSER. 1959. Observations on some subtropical plant-parasitic nematodes in Florida. Soil and Crop Sci. Soc. Fla. Proc. 19:443-451.

Soybean was established as a host of *Radopholus*. This is believed to be the first record of this nematode on soybean.

360. VEECH, J. A., and B. Y. ENDO. 1968. Enzyme localization in Lee soybeans infected with the root-knot nematode Meloidogyne incognita acrita. Phytopathology 58(7):1070.

Enzymes were studied in fresh tissue sections of Lee soybeans infected with the root-knot nematode, M. incognita acrita.

361. WEBBER, A. J., JR., and K. R. BARKER. 1967. Biology of the pseudo root-knot nematode Hypsoperine ottersoni. Phytopathology 57(7):723-728.

In a host range study, Hysoperine ottersoni failed to reproduce on soybean variety Chippewa.

362. WEISS, M. G. 1949. Soybeans. Adv. in Agron. 1:77-157.

This includes a review of recent literature, chiefly North American, on the soybean diseases, including root-knot.

363. WHITEHEAD, A. G., M. A. LEDGER, and L. KARIUKI. 1963. Plant Nematology East African Agr. and Forestry Res. Organ., Ann. Rpt. 1962:54-56.

Twenty isolates of Meloidogyne spp. from Tanganyika were tested on soybeans. Variety 'Rodesian ex Seafondale' was most resistant.

364. ______ A. L. MATSON, and L. F. WILLIAMS. 1956. Severe root-knot nematode infection of the soybean variety Lee. U.S. Dept. Agr. Plant Dis. Rptr. 40(3):176.

Lee variety of soybean was highly susceptible to Meloidogyne arenaria in Dunklin County. Mo. No galls were observed on 11 other varieties in a field test.

365. WHITTLE, W. O., and B. D. DRAIN. 1935. The root-knot nematode in Tennessee. Its prevalence and suggestions for control. Tenn. Agr. Expt. Sta. Cir. 54, 8 pp.

Plants were classified according to severity of infestation by root-knot nematode. Most varieties of soybean were badly infected, but Biolxi was slightly infected, and Laredo was highly resistant.

366. WIESER, WOLFGANG. 1956. The attractiveness of plants to larvae of root-knot nematodes. II. The effect of excised bean, eggplant, and soybean roots on Meloidogyne hapla Chitwood. Proc. Helminthol. Soc. Wash. 23:59-64.

The roots of soybean variety Bansei show variation of attractiveness and replusion of larvae, depending on location of root.

367. WILLIAMS, L. F., A. L. MATSON, and J. M. EPPS. 1963. A fourth locus effecting resistance to the cyst nematode (Heterodera glycines) in the soybean. (Abs.) Proc. Soc. Agron. Meeting, Denver. Colo.

In addition to the three recessive alleles, which have been reported, a dominant allele at the fourth locus was found to be necessary for resistance to the soybean-cyst nematode. This fourth allele is closely linked to black seedcoat color.

368. WINSLOW, R. D. 1954. Provisional list of host plants of some root eelworm (Heterodera spp.). Ann. Appl. Biol. 41(4):591-605.

In host-range tests, Heterodera schachtii var. trifolii parasitized the roots of soybeans. The beet eelworm, H. schachtii, and the cabbage eelworm, H. crucifera, failed to parasitize soybean.

369. WINSTEAD, N. N., and C. B. SKOTLAND. 1956. Eradicant treatments for narcissus bulbs and gladiolus corms harboring soybean-cyst nematode cysts. (Abs.) Phytopathology 46(1):31.

Hot water, formalin, and Dowcide B as eradicant treatments of the soybean cyst nematode were evaluated.

370. ______ and C. B. SKOTLAND. 1957. Eradicant treatments for narcissus bulbs and gladiolus corms harboring soybean-cyst nematode cysts. Phytopathology 47(2):67-69.

Chemical treatments of bulbs and corms that harbor the cyst nematode as contaminants are reported.

371. ______ C. B. SKOTLAND, and J. N. SASSER. 1955. Soybean-cyst nematode in North Carolina. U.S. Dept. Agr. Plant Dis. Rptr. 39(1):9-11.

A description of a nematode found in the roots of soybeans is given. The cyst-forming nematode of the genus Heterodera was found parasitizing soybeans in southeastern North Carolina; it was identified as H. glycines.

372. WYLLIE, T. D., and D. P. TAYLOR. 1960. Phytophthora root rot of soybeans as affected by soil temperature and Meloidogyne hapla. U.S. Dept. Agr. Plant Dis. Rptr. 44(7):543-545.

Inoculation of Harosoy soybeans with both the fungus Phytophythora sojae and the nematode Meloigodyne hapla caused more severe symptoms, as expressed by plant heights, dry weight and postemergence loss in stand, than either pathogen alone. The fungus was the primary cause of the damage, with the nematode acting as a contributing factor.

373. YAMADA, S. 1961. Plant injuries caused by the soybean-cyst nematode and control measures from the view point of soil sciences. Pts. 1, 2, and 3. Nogyo-oyobi-Engei 36:469-474. 633-636, and 797-800. [In Japanese.]

374. ____ 1963. Investigations on the damage of soybean nematode (Heterodera glycines) and its control from the view point of Soil. Soil Sci. and Plant Nutr. 9(4):15-20.

375. YOKOO, T. 1936. Host plants of Heterodera schachtii Schmidt and some instructions. Korea Agr. Expt. Sta. Bul. 8(2/3):167-174.

He reported that the soybean-cyst nematode had been ohserved in Korea.

376. ____ 1951. Golden nematode and its relative. Ann. Phytopath. Sci. Japan 15(3/4):166-167.

The paper lists soybeans as a host of a cyst-forming nematode. He considered the soybean-cyst nematode to be Heterodera gottingiana.

377. YOSHIMEKI, M., K. KOBASHI, and T. SASAKI. 1956. Analytical study of injury by the soybean-cyst nematode. Heterodera glycines Ichinohe. Bul. Inst. Agr. Res., Tohoku Univ. 7(3):179-183. [In Japanese with English summary.]

To clarify the injury caused by the soybean-cyst nematode on vegetative and generative growth of the soybean plant, damaged control and plants were obtained from the soybean field. Plant height, number of nodes, number of branches, number of pods, number of beans, percentage of matured grains, and weight of 100 beans were examined.

378. ____ and T. SASAKI. 1956. Analytical study of injury by the soybean root miner with special reference to the further injury by the soybean-cyst nematode or rat. Inst. Agr. Res. Bul. Tohoku Univ. 7(3):185-190. [In Jananese with English summary.]

The samples examined in the present work were obtained from the soybean field at Ahiwahime-Village and Toyaski-Village in Miyagi Perfecture to analyze the injury caused by the soybean root miner and further injury by the soybean-cyst nematode or the rat to the growth of the soyhean plant.

379. YOUNG, J. R., and R. D. RIGGS. 1964. Identification of the amino acids of nematode resistant and susceptible soybeans. Proc. Ark. Acad. Sci. 18:46-49.

The free amino acid pools of various soybean varieties and lines were investigated by two-dimensional chromatographic methods. Comparisons were made between soybean-cyst nematode resistant and susceptible varieties. No consistent quantitative differences were observed, and exact quantitative measurements were not made.

380. YUHARA, IWAO, and HARUO INAGAKI. 1963. [Studies on the resistance of soybean plants to the soybean-cyst nematode, Heterodera glycines. II. The relations between the development of larvae invaded in the roots and the resistance of soybean varieties.] Hokkaido Natl. Agr. Expt. Sta. Res. Bul. 80:94-102. [In Japanese with English summary.]

This paper discusses the results of experiments on the mechanism of varietal differences for resistance to the soybean-cyst nematode, Heterodera glycines.

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